Network Solutions
to IEEE 802.3, 802.3u
and 802.11a/b/g/h

Brochure • February 2006

simatic net

INDUSTRIAL ETHERNET

SIEMENS

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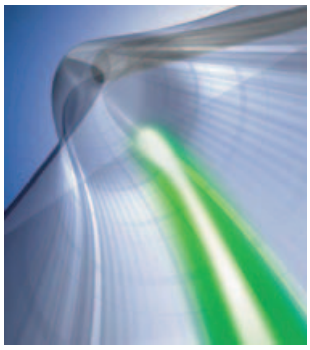
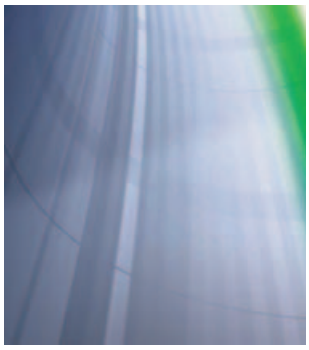




Introduction

The demand for high network availability for a high-performance network in the various automation applications is rising continuously.

With a market share of over 90%, Ethernet is today's leading network for LAN applications worldwide and is the basic technology of the Internet for worldwide networking.

Industrial Ethernet offers a powerful area and cell network conforming to IEEE 802.3/802.3u (ETHERNET) and 802.11a/b/g/h (Wireless LAN) for industrial applications.

The various options of the intranet, Extranet and Internet that are already available today in the office sector can also be used in factory and process automation and building automation by means of the Industrial Ethernet. This permits powerful data communication even in hostile industrial environments.

The Ethernet technology which has proven successful over many years is used in combination with switching, full duplex and autosensing to give the user the opportunity of adapting the necessary performance precisely to the requirements.

Industrial Communication – a pillar of TIA

Totally Integrated Automation (TIA) stands for an integrated range of products and systems for automation in all areas – from incoming goods, through the production process to the dispatch of goods, from the field level, through the production control level to the connection to the corporate management level:

- An integrated software toolset supports all project phases, from the selection of hardware, through the programming to the diagnosis and maintenance.
- The tools access a common database.
- This saves input work and insures project-wide consistency.

Outstanding features:

Industrial Ethernet offers essential supplements to the Ethernet technology for harsh industrial environments:

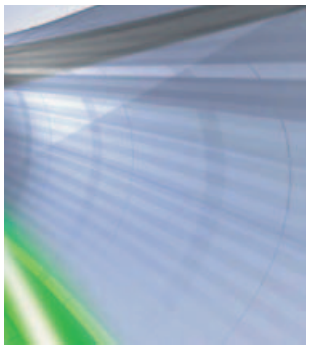
- Investment protection through continuous compatible further development
- Network components for use in harsh industrial environments
- Fast on-site assembly and commissioning using the Fast-Connect cabling system with RJ45 technology
- High availability of the networks due to ring redundancy and redundant power supply
- Continuous monitoring of network components through a simple and effective signaling concept
- Almost unlimited communications performance, since scalable performance is available through switching technology if required
- Networking of widely differing application areas, such as office and production areas
- Data reservation in the case of Industrial Wireless LAN (IWLAN)
- "Rapid Roaming" for Industrial Wireless LAN (IWLAN) for high-speed forwarding of mobile stations between various access points
- Company-wide communication due to interface options via WAN (Wide Area Network) technology such as ISDN or the Internet
- Precise time assignment of events in the overall plant due to plant-wide timing

SIMATIC NET relies on this proven technology. Siemens has established well over two million connections worldwide in tough industrial environments subject to electromagnetic interference.

With the aid of switching technology, the ranges are almost unlimited. In addition, Industrial Ethernet offers the option of wireless communication that can be seamlessly integrated into the network structure. This means that information is available anywhere at any time and mobile access is made possible through Industrial Wireless LAN to the Intranet/ Internet .

Industrial Ethernet uses data communication to exchange data between programmable controllers or between a programmable controller and intelligent partners (e.g. PCs).

Industrial Ethernet enables high-performance communication networks to be created in extensive linear, ring or star configurations.



PROFINET –
Industrial Ethernet standard for automation

PROFINET is the innovative and open Industrial Ethernet standard (IEC 61158) for industrial automation.

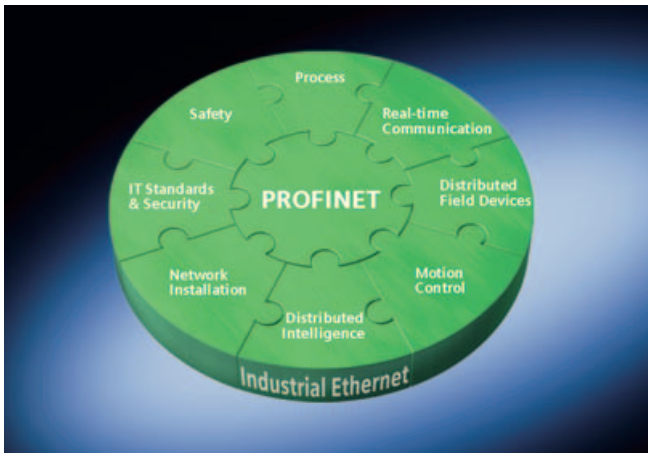
PROFINET uses the existing IT standards and permits the communication from the field level to the management level as well as plant-wide engineering.

Real-time communication

PROFINET is based on Industrial Ethernet and uses the standard TCP/IP (Transport Control Protocol/Internet Protocol) for parameterization, configuration and diagnosis. Real-time communication for the transmission of useful/process data is performed on the same line. PROFINET devices can support the following real-time properties:

- **Real-Time (RT)**
  uses the option of prioritizing and optimizing the communication stacks of the stations. This makes high-performance data transmission possible with standard network components in the field of automation.
- **Isochronous Real-Time (IRT)**
  Hardware-supported real-time communication permits, for example, isochronous data transmission with very short update cycles for highly dynamic motion control applications

The ASIC ERTEC (Enhanced Real-Time Ethernet Controller) supports both real-time properties and is the basic technology for integrated system solutions using PROFINET. In addition to being integrated into Siemens Products, the ERTEC technology is also made available to other manufacturers.
The development of own devices is supported in the form of Development Kits and Competence Centers.

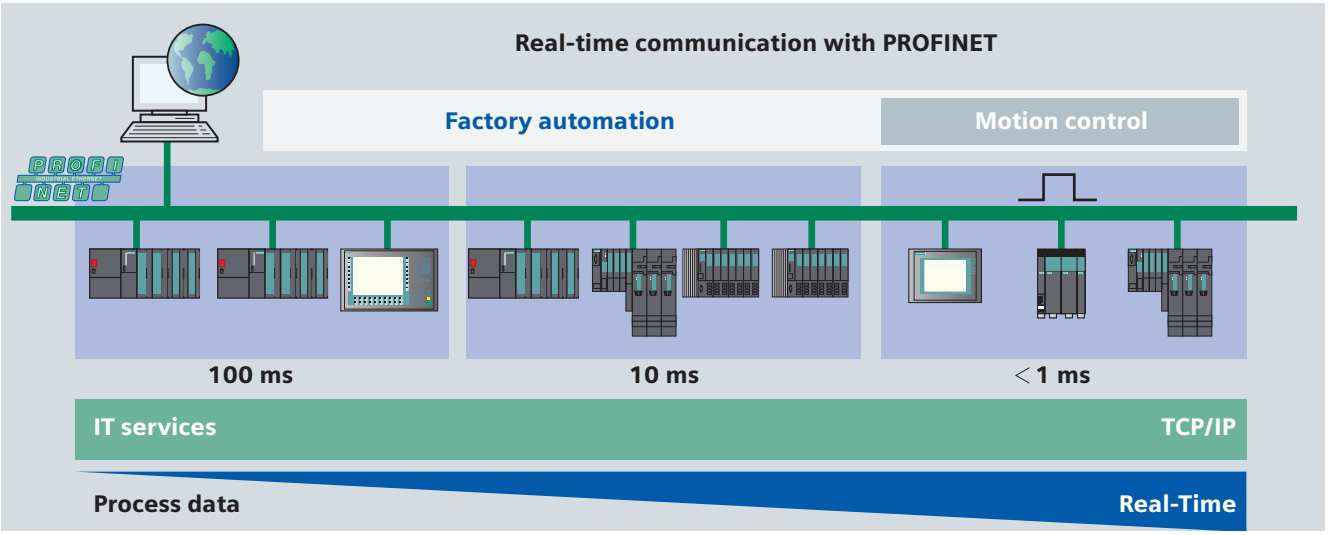


Distributed field devices

PROFINET IO enables distributed field devices (IO devices such as signal modules) to be connected directly to Industrial Ethernet. During configuration with STEP 7, these field devices are assigned to a central controller (the "IO controller"). Existing modules or devices can continue to be used with PROFINET-compatible interfaces or links, which safeguards existing investments by the PROFIBUS users.

Fieldbus integration

PROFINET permits easy integration of existing fieldbus systems. This requires the use of a proxy, which is a master of the PROFIBUS or AS Interface system on the one hand and a station in the Industrial Ethernet on the other hand and which supports PROFINET communication. This protects the investments of plant operators, mechanical and plant engineers, and device manufacturers.



Motion Control

On the basis of PROFINET and using isochronous real-time (IRT) it is also possible to implement very fast, isochronous drive controls for high-performance motion control applications without any great expense.
The standardized drive profile PROFIdrive permits vendor-independent communication between motion controllers and drives, regardless of whether the bus system is Industrial Ethernet or PROFIBUS.
Standard IT functions can be used at the same time on the same line without adversely affecting the real-time communication.

Distributed intelligence and machine-machine communication

PROFINET supports distributed automation on the basis of Component based Automation – the modular solution for machine and plant engineering within the context of Totally Integrated Automation.
Machines and plants can be broken down into reusable, intelligent modules. These modules include the mechanical and electrical/electronic components and application program of a plant section.

Network installation

PROFINET enables the network to be installed without any specialist knowledge. The open standard based on Ethernet meets all the requirements relevant to the industrial sector. PROFINET permits the simple construction of the usual network topologies such as star, tree, line and ring for greater reliability and using industry-standard cabling.

PROFINET offers new functions and applications for wireless communication with Industrial Wireless LAN. This enables technologies subject to wear, such as trailing cables, to be replaced and permits driverless transport systems or personalized operating or maintenance devices to be used. Industrial WLAN is standard-based but also offers additional functions that permit the high-performance connection of field devices to controllers:

- "Data reservation"
  is used for reserving the bandwidth between an access point and defined clients. This ensures high, reliable performance for this client, regardless of the number of clients operated at the access point.
- "Rapid Roaming"
  for the fast handover of mobile stations between different access points.

IT standards

In the context of Web integration, the data of PROFINET components is presented in HTML or XML format. Regardless of the tool used, information at the automation level can be accessed from any location using a standard Internet browser, thereby considerably simplifying commissioning and diagnosis.

Security

PROFINET defines a graduated security concept that can be used without any special knowledge and that largely rules out any operating errors, unauthorized access or manipulation without impeding the production operation. For this the SCALANCE S product range is available with software or hardware modules.

Safety

The PROFIsafe safety profiles (compliant with safety standard IEC 61 508), which has been tried and tested with PROFIBUS and which permits the transmission of standard and safety-related data on a single bus cable, can be used regardless of the bus medium.

PROFIsafe is the first profile for failsafe communication for the Ethernet to be certified by the German Technical Inspectorate. The also permits wireless communication for failsafe applications with Industrial Wireless LAN.

PROFINET thus permits the implementation of failsafe applications with integrated configuration throughout the network – not only when designing new plants, but also when upgrading existing ones.

Process

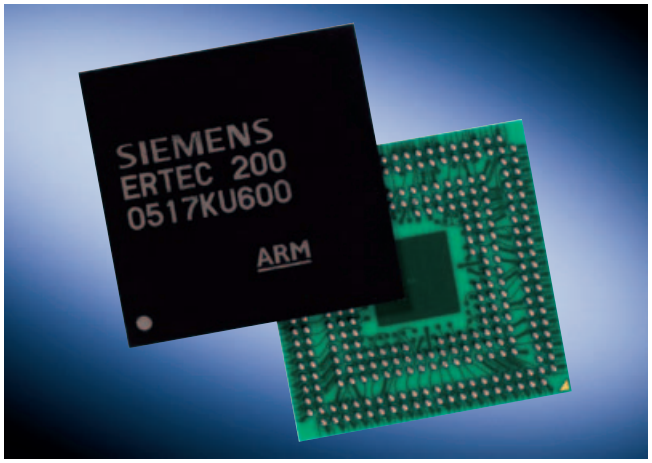
PROFINET is the standard for all applications in automation. By means of the PROFIBUS integration, it also includes the process industry – including hazardous areas.

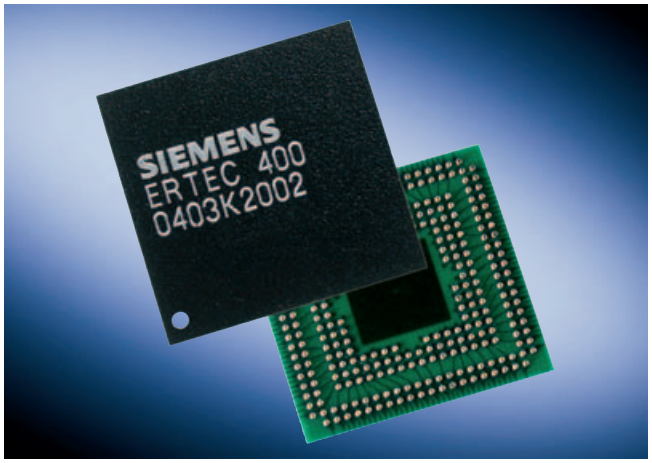
- **PROFINET is the open Industrial Ethernet standard for automation**
- **PROFINET is based on Industrial Ethernet**
- **PROFINET uses TCP/IP and IT standards**
- **PROFINET is Real-Time Ethernet**
- **PROFINET permits seamless integration of fieldbus systems**

Technology components – Real time in the Industrial Ethernet

Based on the transmission procedures of the IEEE 802, the ASICS of the ERTEC series offer all PROFINET real-time properties: Real-Time (RT) and Isochronous Real-Time (IRT). To this end, they intelligently combine the switching mechanisms "Cut Through" and "Store and Forward".

In this way, consistent plant and machine solutions can be implemented.





ASICs for real time

The Industrial Ethernet ASICs of the ERTEC series contain all the functions that are required for high-performance system features in the automation industry.

The performance is considerably increased by the hardware-supported pre-processing of real-time communication.

The integrated switch offers decisive cost benefits and facilitates the use of standard linear topologies in the field area.

ERTEC 200 PN IO (available soon)

The ERTEC 200 is a powerful, low-cost Ethernet controller for

- the development of PROFINET IO devices, such as distributed IO with real-time-capable Ethernet connection that raise the previous automation performance on the basis of Switched Fast Ethernet
- field devices with or without their own host processor, e.g. drives

Thanks to its small size, the ERTEC 200 can be implemented where space is at a premium and can be used as a system-on-chip implementation for simple devices or linked to the host of the target hardware.

ERTEC 400 PN IO

The ERTEC 400 is used primarily for

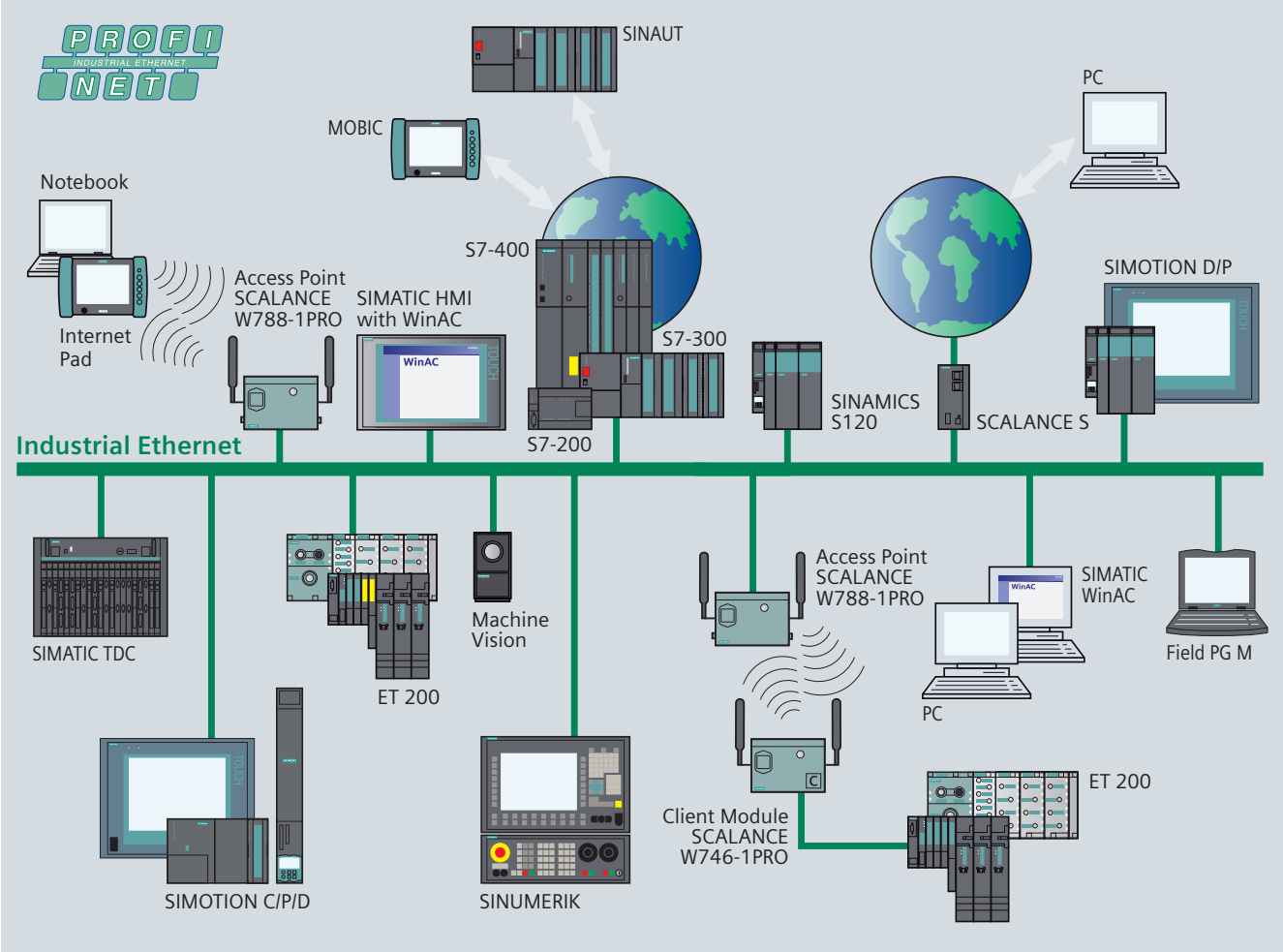
- IO controllers, such as programmable logic and numeric controllers
- Communication processors for PC-based systems
- Active network components with real-time function.

PCI, the bus standard of the PC world is a component of this ASIC and thus saves space, time and money when integrating into PC-based system environments.

Various development packages are available for supporting in-house development projects with ERTEC

- DK-ERTEC 400 PN IO development kit
- DK-ERTEC 200 PN IO development kit (available soon)
- Development packages for in-house development using standard controllers

Industrial Ethernet
Solution options



Solution options with Industrial Ethernet

Industrial Ethernet enables large, powerful and redundant networks to be constructed. Components designed specially for the industry allow the problem-free exchange of data over long distances.

Rugged network components for the widest variety of requirements, e.g. electrical or optical components in linear, ring or star configurations, operating at 10, 100 or 1000 Mbit/s, thus form the backbone of the industrial communication.

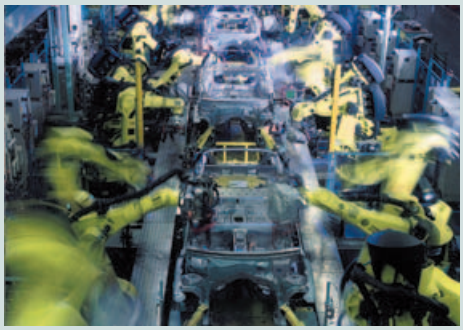
Communication processors which – depending on the target system – are offered in different versions, performance classes and for different applications, implement the connections of the stations to the network. With its universally applicable SIMATIC NET components, Industrial Ethernet can be used in many different sectors.

Industrial Ethernet
Application examples

Automotive production

In automotive production it is possible to implement production lines with variable speeds or options for controlling the plant while it is in operation. Many variables have to be flexible in order to allow fault-free production. This makes plant availability increasingly important.

A downtime caused by a repair is usually more expensive than controlled monitoring of systems for wear or possible faults. With the aid of high-performance components in the communication, for example, errors can be located and reported quickly.



Food, beverages and tobacco

The flow of materials, e.g. potatoes, from delivery, through sorting and acceptance to the dispatch of the packaged potatoes, is programmed in advance and can be modified from the host computer according to capacity and demand.

Operating states and groups of conveyor systems can also be monitored and influenced in exactly the same way as the filling of silos. The coordination of different sorting systems is also a sub-task of the communication, as is the automatic individual ventilation of the potatoes.

Building automation

Building automation has long been incorporated in parking garages. Free spaces are announced at the entrance to the parking garage and drivers are guided along the shortest route by means of illuminated directional signs. A contactless sensor that is mounted on the ceiling acts as a parking lot attendant and regularly scans its parking space by ultrasound. If someone drives the wrong way on a ramp or if a traffic jam starts to form, an alarm is set off in the control room.

A powerful communication processor collects and coordinates the data and visualizes this, for example, in a computer.

Waste water

Waste water treatment demands special properties of automation components and communication, such as their use in permissible temperature ranges, electromagnetic compatibility or fast signaling in the event of faults. Filter lines, pumps or measuring devices can be monitored and controlled from the control center so that the smooth operation of the plant can be guaranteed.

A powerful communication system routes the corresponding data reliably from the sensors to the control center. These can be visualized and controlled there by means of a computer.

Networking options

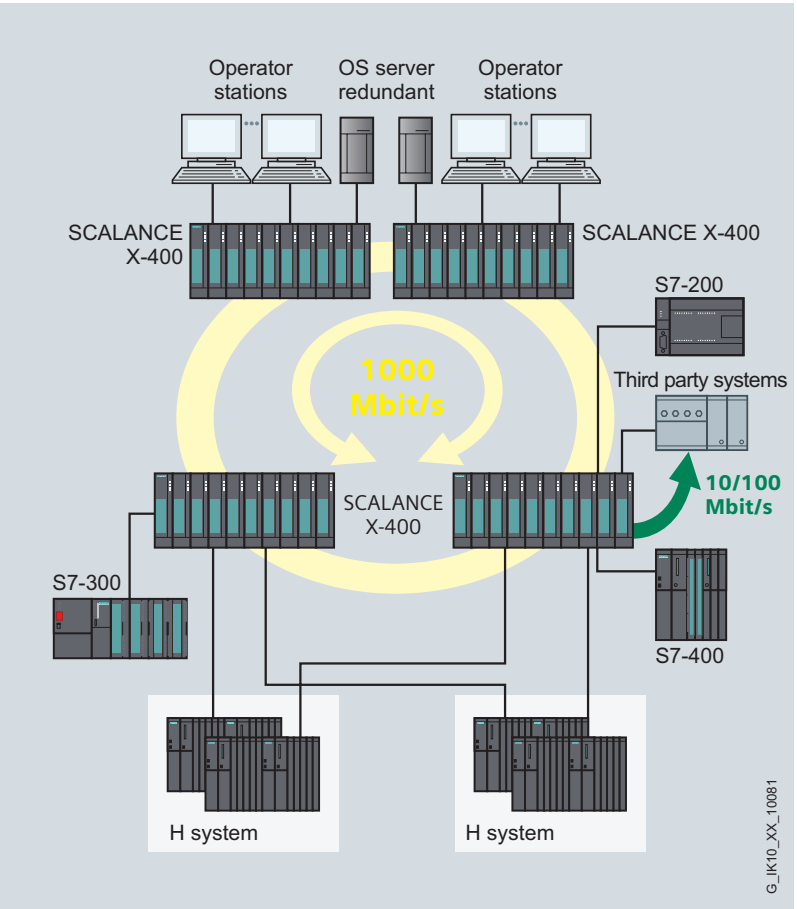
Networks with switches

Switches (SCALANCE X, OSM, ESM) permit the construction of electrical or optical networks in linear, star or ring topologies.

Fiber-optic or Twisted Pair cables are used as the transmission media between the switches. Data terminals or network segments are connected over twisted-pair cables.

The switching technology permits parallel communication, i.e. a network is divided into several segments, thereby facilitating a reduction of the load separation. In each of these segments local data traffic is possible independently of other segments. In the overall network, several messages can therefore be en-route simultaneously.

The performance gain is due to the simultaneity of several message frames.



The switching functionality offers crucial advantages.

- The formation of subnetworks and network segments is possible
- The data throughput and thus the network performance are significantly raised by the structuring of the data traffic
- The rules for network configuration are easily applied
- Network topologies with 50 switches and an overall span of up to 150 km are readily implemented without having to consider signal runtimes
- An unlimited expansion of the network is possible by connecting individual collision domains/subnetworks
- Existing networks can be expanded simply without adverse effects by means of switches.

Functionality of the Industrial Ethernet switches

- Depending on the number of available interfaces, switches are capable of temporarily and dynamically connecting several pairs of subnetworks or nodes simultaneously
- By filtering the data traffic on the basis of the Ethernet (MAC) address of the data terminals, local data traffic remains local and only data to stations in another subnetwork is forwarded by the switch
- Raising the number of connectable data terminals in comparison with a classic Ethernet network
- Limiting error propagation to the subnetwork concerned

Highlights of the Industrial Ethernet switches SCALANCE X

The SCALANCE X product series is a new generation of Industrial Ethernet switches from SIMATIC NET. It consists of different, complementary product lines that are also coordinated and adapted for the respective automation task.

- A robust, innovative and space-saving housing design, which can very easily be integrated into a SIMATIC automation solution; free choice between a 35 mm standard DIN rail, S7-300 section rail or direct wall mounting
- The sleeve design together with the PROFINET-compliant Industrial Ethernet FastConnect RJ45 Plug 180 from SIMATIC NET offers additional tension and bending stress relief
- High Speed Redundancy permits very fast reconfiguration times (≤ 0.3 seconds) with up to 50 switches in the case of SCALANCE X-200, SCALANCE X-200IRT or SCALANCE X-400

Redundant networks

Industrial Ethernet networks can be constructed redundantly with switches from the SCALANCE X product line, OSM or ESM. By closing the ring, the network remains operational upon failure of one transmission path; in the event of a network component failure, only those stations connected directly to it are no longer accessible.

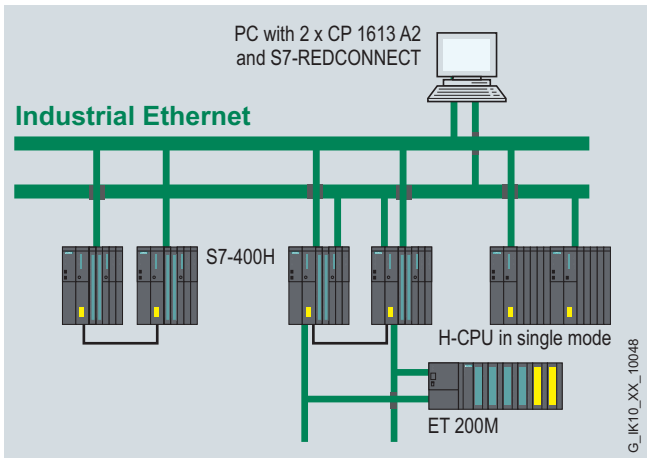
Redundancy by means of software

Using the S7-REDCONNECT software package and the CP 1613 A2 communication processor, PCs can be redundantly connected to the SIMATIC S7-400-H system.

PC applications (e.g. WinCC) that already use S7 communication today (e.g. via the OPC interface) can continue to be used unchanged.

On failure of a subsystem or in the event of a cable break, a switch is made to the reserve system or reserve network (double bus, redundant ring), thereby maintaining the communication.

High-availability communication



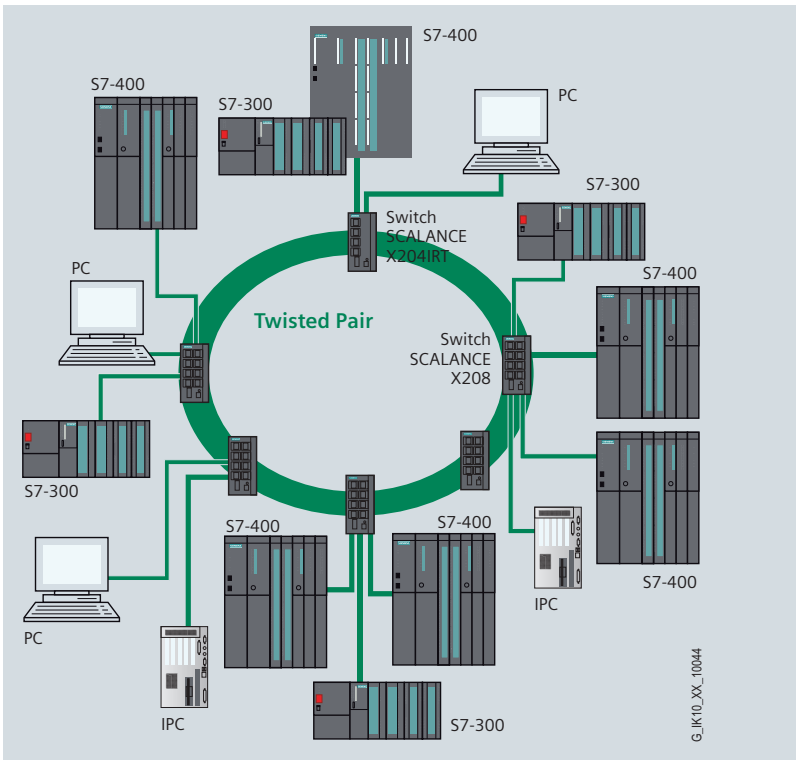
High-speed redundancy – with SIMATIC NET

Extremely fast reconfiguration of the network following an error is indispensable for industrial applications, because the connected data terminals will otherwise disconnect logical communication links. This would result in a process running out of control or emergency shutdown of the plant.

In order to achieve the very fast response times required, SIMATIC NET uses the specially developed High Speed Redundancy procedure for controlling the redundancy. A network can then be reconfigured to form a functional network infrastructure in a fraction of a second. In an optical ring comprising 50 switches, the network will be reconfigured after an error (cable break or switch failure) in less than 0.3 seconds. The connected data terminals remain unaffected by the changes in the network and logical connections are not disconnected. Control over the process or application is assured at all times.

In addition to implementing high-speed media redundancy in the ring, SIMATIC NET switches also offer the functions required for high-speed redundant coupling of rings or network segments. Network segments in any topology or rings can be coupled over two switches.

Configuration with high-speed redundancy in the electrical ring



Network selection criteria

On the basis of the listed criteria, you can select the Industrial Ethernet network suitable for your requirements.

	Twisted-pair network	Fiber optic network	Wireless link
Flexibility of the network topology	□ □ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Suitability for high data rates	□ □ ■ ■ 1)	■ ■ ■ ■ 1)	□ □ ■ ■
Networking between buildings	□ □ □ □	■ ■ ■ ■	□ ■ ■ ■
EMC	□ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Simple cable laying	□ ■ ■ ■	□ ■ ■ ■	
Range of cables for special applications	Cables for indoor area; trailing cable; marine cable; FastConnect cables	Cables for indoor and outdoor area; trailing cable; halogen-free cables	–
Effect of power failure	Failure of a subnet 2)	Failure of a subnet 2)	Failure of a subnet 2)
Effect of connection failure	Network breaks down into two subnets that function in isolation 3)	Network breaks down into two subnets that function in isolation 3)	–
Max. length of the network	5000 m 4)	up to 150 km: over 150 km observe signal runtime	1000 m per segment 5)
Max. distance between two network nodes/Access Points	100 m	3000 m multimode 26000 m singlemode	30 m indoor per segment 100 m outdoor per segment
Max. length of connection cable	100 m	3000 m multimode 26000 m singlemode	100 m feeder cable to access point
Pre-assembled cables	yes	yes	no
On-site assembling	without special tool; FastConnect system	with special tool and trained personnel	–
Integrated diagnostics support	LEDs; signal contact; SNMP network management; Web-based management, PROFINET diagnosis	LEDs; signal contact; SNMP network management; Web-based management, PROFINET diagnosis	LEDs; SNMP network management; Web-based management
Redundant network structures	Electrical ring or doubling of the infrastructure (linear bus, star, tree)	Optical ring or doubling of the infrastructure (linear bus, star, tree)	multiple coverage

■ ideal
□ suitable
not suitable

1) Suitable for 10 Mbit/s and 100 Mbit/s and 1000 Mbit/s
2) Protection against subnet failure using redundant voltage supply
3) no effect in ring structure
4) depending on the network components used
5) depending on the antenna used

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Structured cabling and FastConnect

Structured cabling

Structured cabling according to EN 50173 describes the non-application-specific, tree-like cabling of building complexes for IT purposes. A site is subdivided into the following areas:

- Primary area:
  Connecting the buildings of a site
- Secondary area:
  connecting the floors of a building
- Tertiary area:
  IT connection of data terminals on a floor

FastConnect system

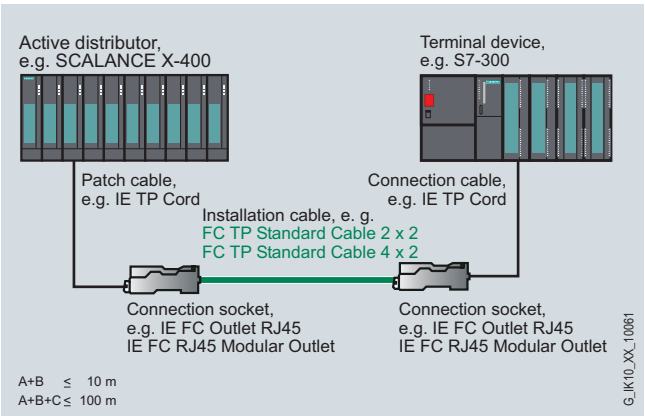
With the FastConnect (FC) system for Industrial Ethernet, structured cabling from the office environment becomes industry-compatible for installation in the production hall.

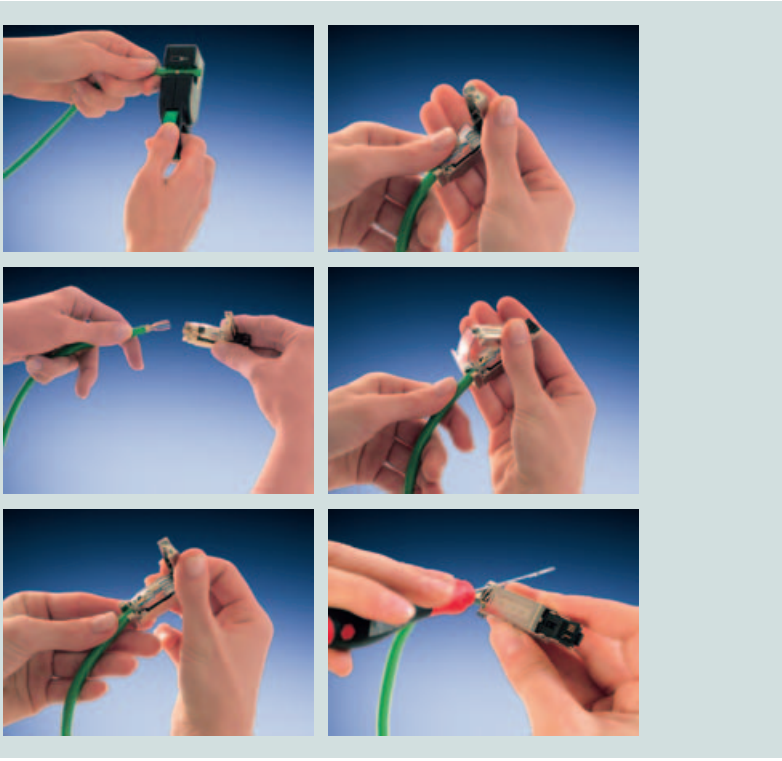
By means of optimally coordinated components, the system permits the construction of industry-standard network structures in the shortest possible time.

By means of the FastConnect stripping technology, the Industrial Ethernet FC cables can be connected quickly and easily to RJ45 connectors. The data terminals and network components are connected over TP Cords.

The Industrial Ethernet FastConnect cables are specially designed for use of the Industrial Ethernet FastConnect Stripping Tool, with which the outer insulation and the braided shield can be stripped accurately in one step. The prepared cable is connected in the RJ45 connectors using the insulation displacement method.

Structured cabling according to EN 50173





FastConnect system technology

Advantages of the FastConnect system

- Comprehensive product range for flexible wiring in industry in accordance with the innovative Industrial Ethernet standard PROFINET
- Faster connection of data terminals thanks to safe stripping of the outer sheath and braided shield in one step
- Easy connection method (insulation-piercing contacts) for 4-core (Cat5) and 8-core (Cat6) Industrial Ethernet FC Twisted Pair installation cables
- Easy assembly of both cable types with the preadjusted FC stripping tool
- Reliable shield contact and strain relief thanks to bolt-on cover
- Excellent EMC shielding and conduction (metal casing); mistakes are prevented thanks to color coding and the transparent terminal cover
- RJ45 cabling technology is used as the permanent standard

Passive network components
Cables

Industrial Ethernet can be constructed as an electrical or optical network. The following cables are offered for the various topologies, requirements or application areas:

Type of conductor	Description	Features	Area of application	
Twisted Pair	**TP Cord**	Patch cables, with RJ45, 15 or 9-pin sub D connectors, assembled	For connecting stations to network components within a control cabinet, up to 10 m cable length	
FastConnect		Installation cables, insulation displacement method, sold by the meter	For direct connection between stations and network components, used for structured cabling, fast and simple attachment of the cables to the FC contacts **Cable variants:**	
	FC TP Flexible Cable GP 2 x 2		• 4-core, flexible, for occasional motion control	
	FC TP Standard Cable GP 2 x 2 **FC TP Standard Cable GP 4 x 2**		• 4-/8-core for universal applications	
	FC TP Trailing Cable GP 2 x 2 **FC TP Trailing Cable 2 x 2**		• 4-core trailing cable for continuous motion control	
	FC Torsion Cable GP 2 x 2		• 4-core, high-flexibility for for continuous motion control (torsion movement)	
	FC TP Marine Cable 2 x 2		• Halogen-free, flame-retardant for cabling in in ships and offshore units	
	Connecting Cable M12-180/M12-180	Pre-assembled with two 4-pole M12 connectors (IP65)	• 4-core connecting cable for IP65/IP67 components	
Hybrid	**IE Hybrid Cable**	Hybrid cable for simultaneous transmission of data (10/100 Mbit) and power (24 V/400 mA); Insulation displacement method,sold by the meter	Industrial and office sector for IE FC RJ45 Modular Outlet and Access Point SCALANCE W with hybrid connector	
Fiber-optic		Glass fiber, sold by the meter or preassembled with 4 BFOC or SC connectors	For indoor and outdoor installation **Cable variants:**	
	FO Standard Cable GP (50/125) **Fiber Optic Cable**		• Rugged standard cable for universal applications	
	FO Ground Cable (50/125)		• Cable protected against the ingress of water lengthwise and transversely for installation outdoors with non-metallic rodent protection; underground laying possible	
	FO Trailing Cable GP (50/125) **FO Trailing Cable (50/125)**		• Cable for use in cable carriers	
	SIENOPYR marine duplex fiber-optic cable (62.5/125)		• Halogen-free, tread-resistant, flame-retardant and marine-approved for cabling in ships and offshore units	

Plug-in connector

IE FC RJ45 Plug

The compact and rugged design of the plug-in connectors allow the IE FC RJ45 Plugs to be used in industrial environments and in equipment from the office environment. The IE FC RJ45 Plugs support quick and easy installation of the IE FC installation cables 2 x 2 (4-core twisted pair cables) in the field.

IE FC RJ45 Modular Outlet

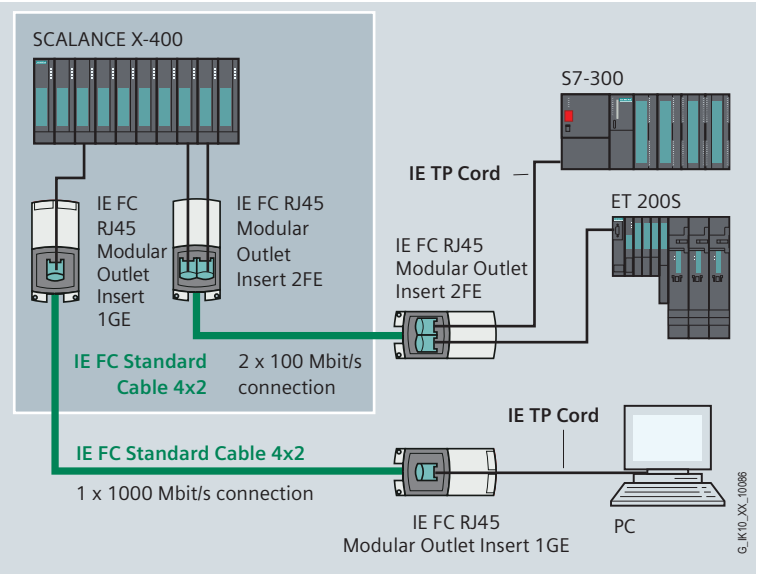
With the IE FC RJ45 Modular Outlet, the 8-core IE FC TP installation cables 4 x 2 can be securely and quickly installed on site. The 8-core cabling system of SIMATIC NET allows transmission rates of 10/100/1000 Mbit/s. This enables two Industrial Ethernet connections to be implemented for Fast Ethernet or a Gigabit Ethernet connection.

The IE FC RJ45 Modular Outlet basic module can optionally be equipped with three different replaceable inserts, as follows:

- IE FC RJ45 Modular Outlet Insert 2FE with 2 x RJ45 sockets for 100 Mbit/s systems
- IE FC RJ45 Modular Outlet Insert 1GE with 1 x RJ45 socket for 1000 Mbit/s systems
- IE FC RJ45 Modular Outlet Power Insert for SCALANCE W IWLAN system with 1 x 24 V, 1 x RJ45 socket

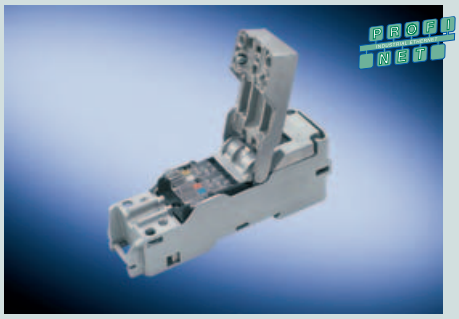
Thus it is possible not only to implement individual device connections, but also 100 Mbit/s dual connections.
100 Mbit/s networks can be upgraded without difficulty to a 1000 Mbit/s network by replacing the insert Replacement of the cabling is not necessary (permanent cabling).

System configuration with IE FC RJ45 Modular Outlet (100/1000 Mbit/s)



IE FC RJ45 Plug

IE FC RJ45 Modular Outlet



IE FC Outlet RJ45

IE FC Outlet RJ45

The IE FC Outlet RJ45 is used as a transition from the rugged IE FC cables used in the industrial environment to preassembled TP Cord cables (10/100 Mbit/s) using an RJ45 socket.

By connecting several FC Outlet RJ45 devices in series, a patch field can be constructed with the required connection density (e.g. 16 outlets over 19" width).

Active network components
Unmanaged Industrial Ethernet Switches

SCALANCE X005 Entry Level

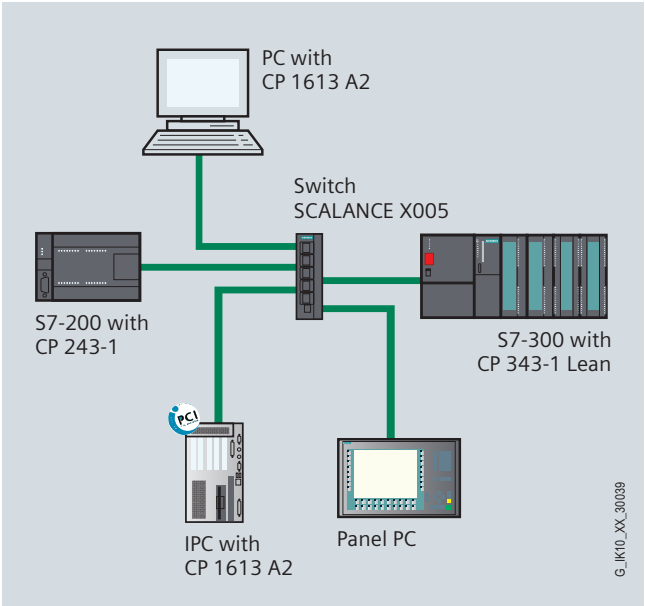
SCALANCE X-100 unmanaged

SCALANCE X005 Entry Level

Unmanaged switch with five ports and diagnosis on the device for use in machine and system islands.

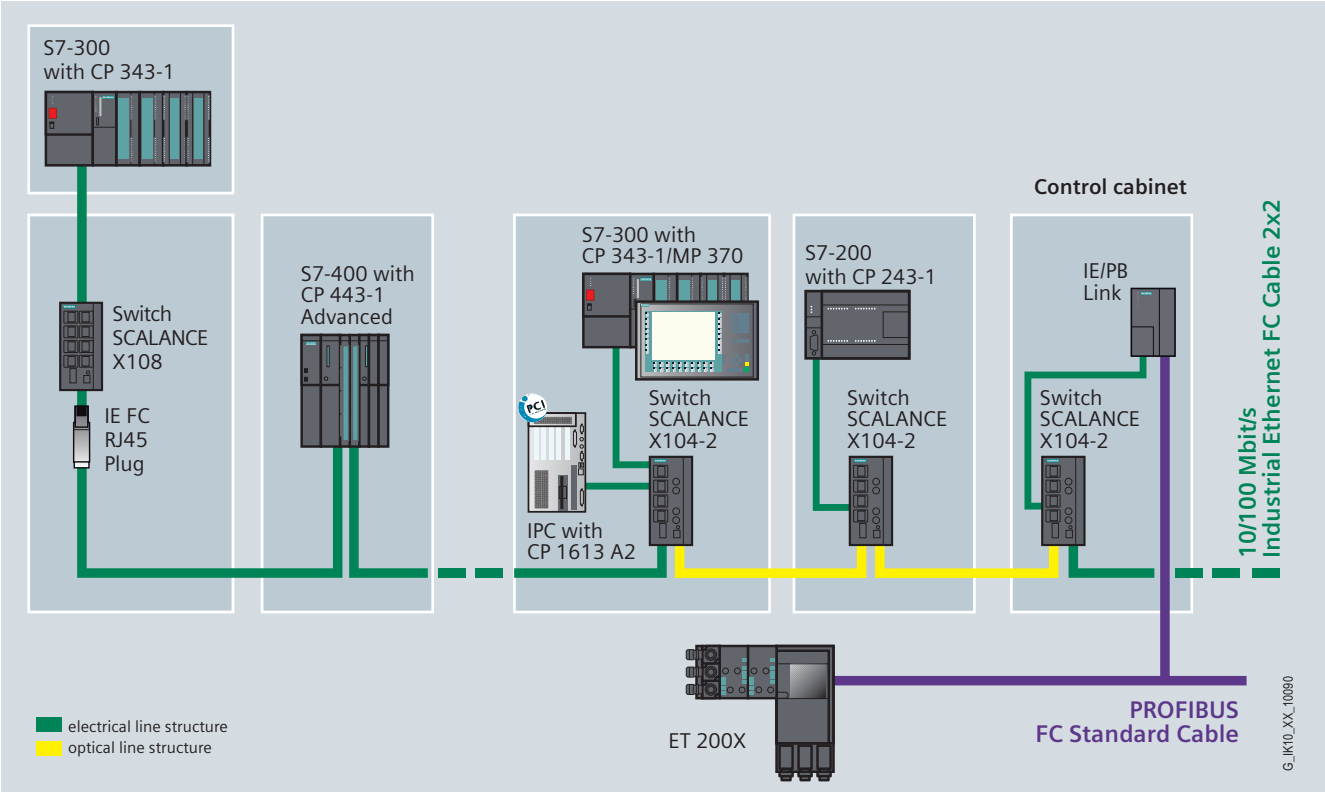
SCALANCE X-100 unmanaged

Switches with as many as eight ports (electrical/optical), redundant voltage supply and signal contact for use in machine-level applications.



Star topology with SCALANCE X005

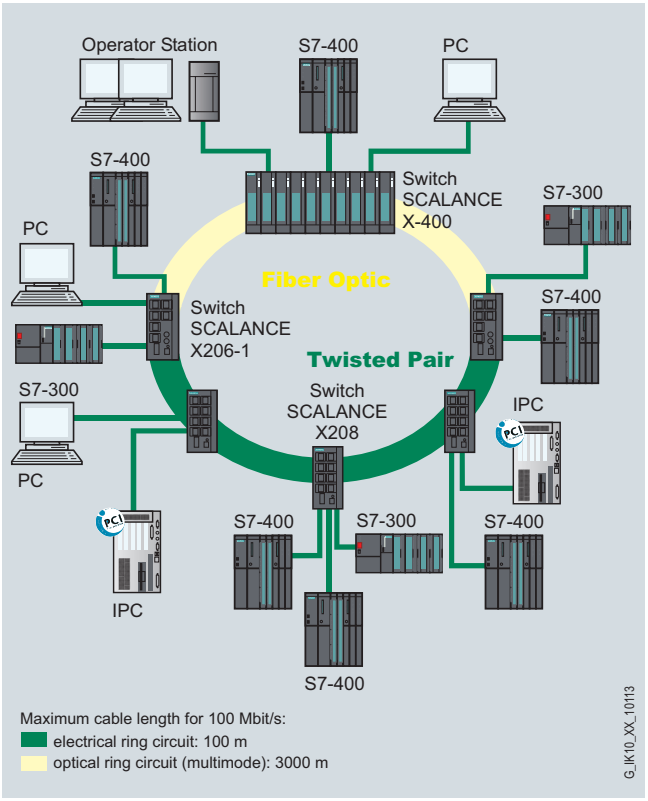
Electrical and optical linear structure with SCALANCE X-100



Managed Industrial Ethernet Switches

SCALANCE X-200 managed

SCALANCE X-200IRT managed



High speed redundancy in the ring with electrical and optical paths

SCALANCE X-200 managed

The extensive range of devices in the SCALANCE X-200 product series includes switches with as many as eight ports (10/100 Mbit/s). They are universally applicable – in machine-level applications as well as in networked plant sections, in electrical or electrical/optical linear, ring or star structures and with single mode up to 26 km. Configuration and remote diagnosis are integrated in the STEP 7 engineering tool. This enhances the availability of the plant. Devices with a high degree of protection (IP65) support installation outside the control cabinet.

SCALANCE X-200IRT managed

In subsystem networks with hard real-time requirements (Real-Time and Isochronous Real-Time (available soon)), the SCALANCE X-200IRT switches can be used. The standard data transmission (TCP/IP) can take place on the same network. Dual network structures are therefore not necessary.

Modular Industrial Ethernet Switches

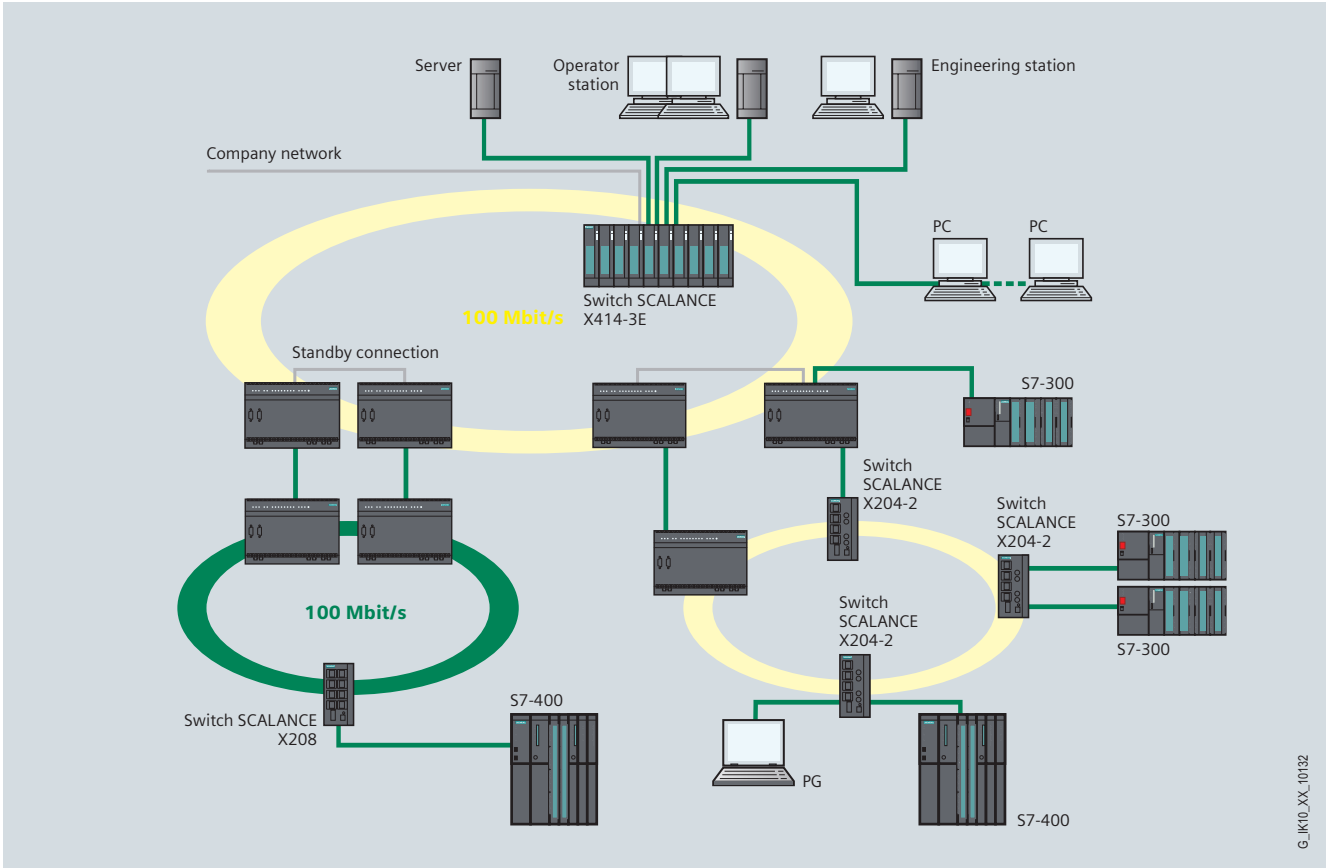
SCALANCE X-400 modular

SCALANCE X-400 modular

The switches of the SCALANCE X-400 product series are suitable for the construction of optical/electrical linear, ring and star topologies (10/100/1000 Mbit/s) for high-performance systems. SCALANCE X-400 switches have a modular structure, in which media modules and extender modules can be connected to the switch as required. These expansions make as many as eight electrical and eight optical ports additionally available.

Due to the support of IT standards, e.g. VLAN, RSTP, Layer 3 , automation networks can be seamlessly connected to existing corporate networks. The SCALANCE X-400 switches are ideally suited, for example, to process control systems such as PCS 7.

Optical and electrical ring with SCALANCE X and OSM (Optical Switch Module) redundantly linked



Industrial Ethernet Switch Modules

Industrial Ethernet ELS

Industrial Ethernet OSM

Industrial Ethernet ESM

Industrial Ethernet ELS

The Electrical Lean Switches (ELS) with four or eight ports (10/100 Mbit/s) permit the construction of electrical Industrial Ethernet linear topologies in the field, but can also be used in a smaller format as star point or star structure.
They are designed for installation in the control cabinet.

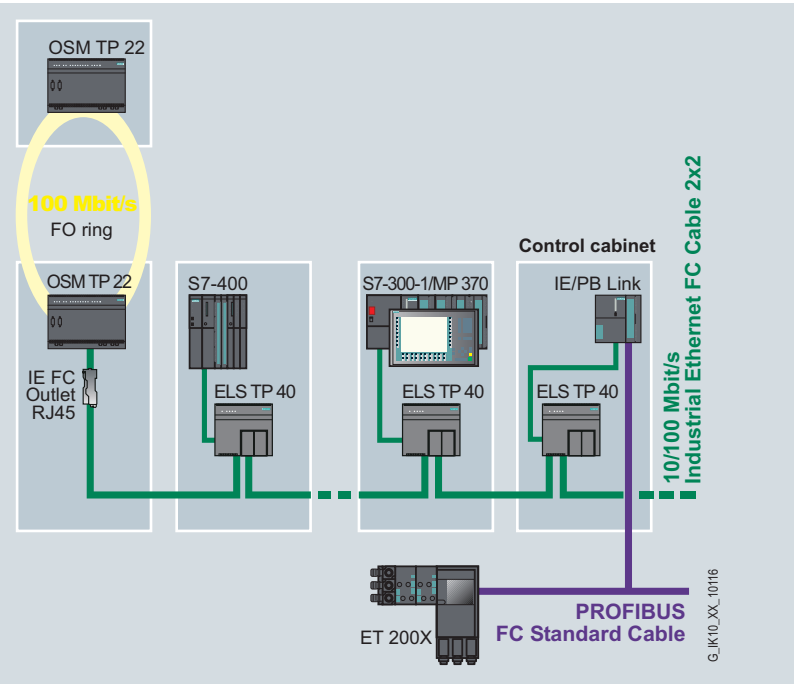
Industrial Ethernet OSM/ESM

Optical Switch Modules (OSM) and Electrical Switch Modules (ESM) are managed Industrial Ethernet Switches for machine-level applications up to and including networked subsystems or larger plant networks in linear, ring and star topologies (100 Mbit/s).

In existing networks, load decoupling and thus increased network performance can be achieved by creating segments (subdividing a network into subnetworks/segments) and connecting these segments to an OSM/ESM. For the construction of an optical ring, OSMs with two fiber-optic ports are required. For each ring, as many as 50 OSMs can be used.

Electrical rings are constructed with two twisted-pair ports of the ESM. For each ring, as many as 50 ESMs can be used.

Apart from the two ring ports, OSM/ESM have six other ports (with either RJ45 or ITP interfaces) to which data terminals or network segments can be connected.



Network topology with ELS TP40

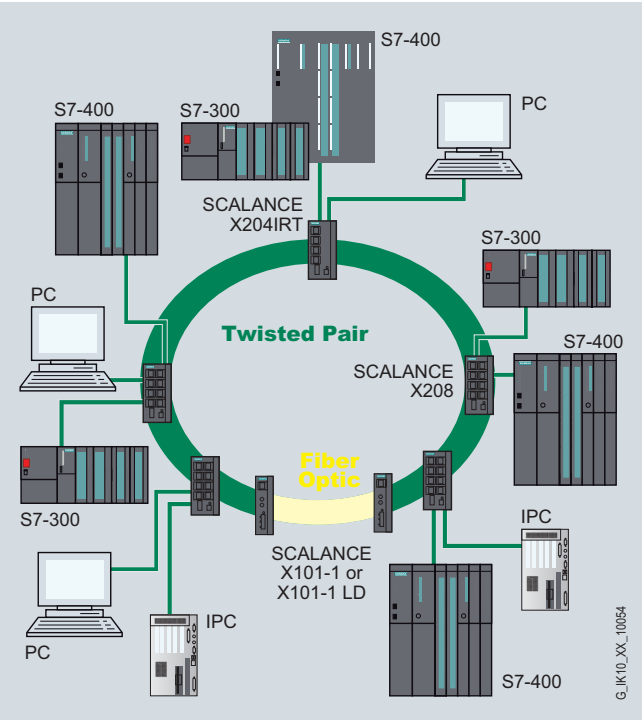
Industrial Ethernet media converter

SCALANCE X media converter

The Industrial Ethernet media converters of the SCALANCE X-100 product series are unmanaged Industrial Ethernet media converters with various port versions. They enable the targeted use of fiber-optic cables in Industrial Ethernet networks and are the ideal solution for converting electrical signals into optical signals.

All product versions have a rugged metal enclosure (IP30) for compact installation in the cabinet, on standard DIN rails, on S7-300 racks or for direct wall mounting. The sleeve on the RJ45 port integrated in the front of the enclosure, in connection with the PROFINET-compliant Industrial Ethernet FastConnect RJ45 Plug connector, ensures continuous and reliable data communication. The interaction of sleeve and IE FC RJ45 Plug relieves the RJ45 socket of the media converter from tension and bending strain.

The SCALANCE X-100 media converters have a redundant voltage supply (2 x 24 V DC) and an error signal contact that is configured via a SET pushbutton on the front of the unit. On-site diagnostics are implemented by means of LEDs.



Industrial Ethernet OMC

The Industrial Ethernet OMC TP11 and OMC TP11-LD Optical Media Converters permit the specific use of fiber-optic cables in Industrial Ethernet networks. 100 Mbit/s full duplex twisted-pair interfaces of terminals or of network components are converted with OMC into fiber-optic interfaces.

Module type	Type and number of ports							Features						
	Gigabit Ethernet	Fast Ethernet												
	10 / 100 / 1000 Mbit/s	10 / 100 / 1000 Mbit/s				100 Mbit/s								
	TP / FO	Twisted Pair				Fiber Optic								
		RJ45	M12	Fast Connect	ITP	Multimode BFOC	Singlemode BFOC	Compact housing	LED diagnosis	SIMATIC environment	2 x DC 24 V	Signal contact	Local display (SET button)	Ring redundancy without RM
SCALANCE X101-1		1				1		■	■	■	■	■	■	■
SCALANCE X101-1LD		1					1	■	■	■	■	■	■	■
OMC TP11		1				1		■	■	■	■	■		■
OMC TP11LD		1					1	■	■	■	■	■		■

■ suitable
not suitable

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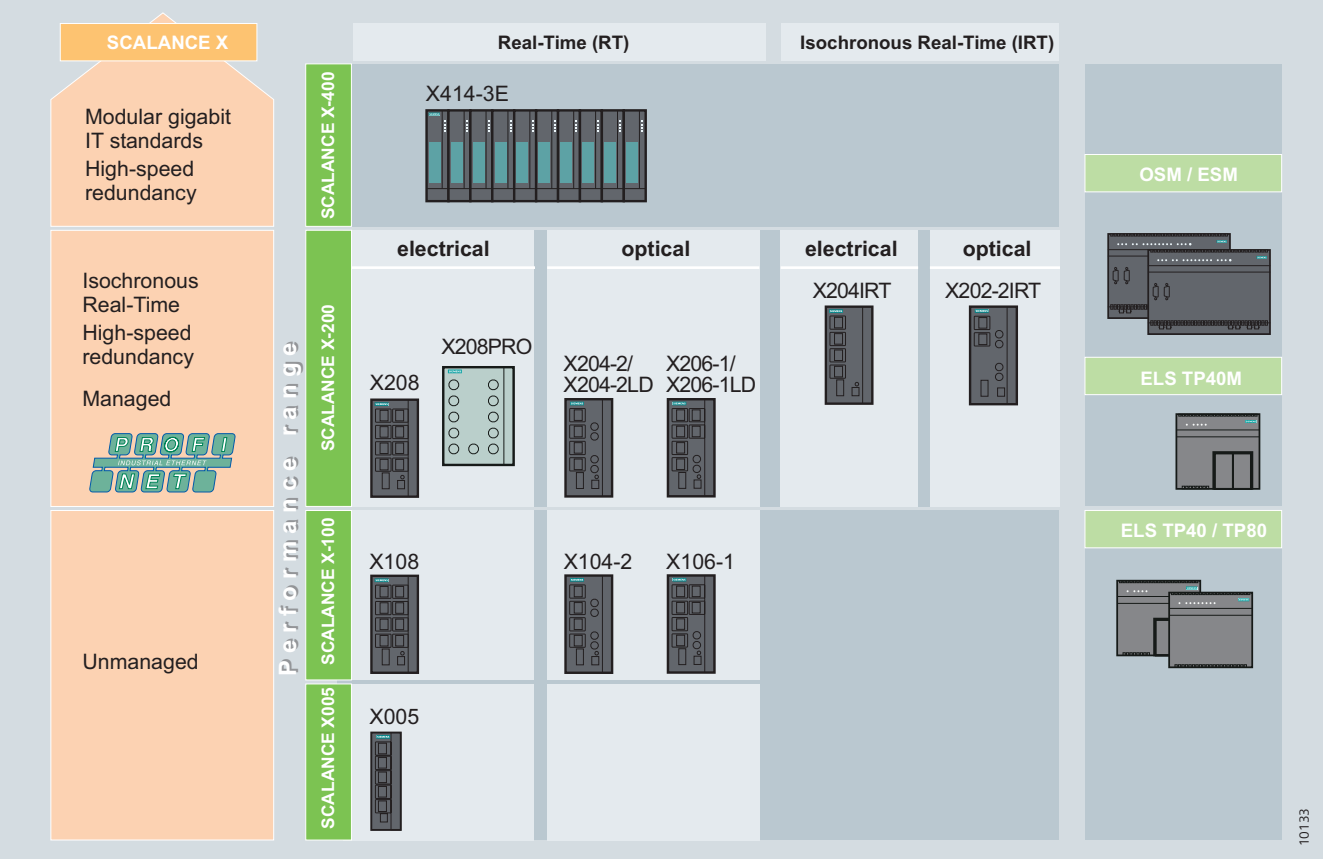
Active network components
Overview



Functions

Module type	Type and number of ports							Features																				
	Gigabit Ethernet	Fast Ethernet																										
	10 / 100 / 1000 Mbit/s	10 / 100 Mbit/s				100 Mbit/s																						
	TP / FO	TP				Fiber Optic																						
		RJ45	M12	Fast Connect	ITP	Multimodo BFOC	Monomodo BFOC	Compact housing	LED diagnosis	SIMATIC environment	2 x DC 24 V	Signal contact	Local display (Set button)	Diagnosis: Web, SNMP, RMON	PROFINET diagnosis	Ring redundancy without RM	C-PLUG	Ring redundancy with RM	Standby redundancy	IRT capability	Gigabit technology	Modular design	Digital inputs	Office features (VLAN, RSTP, IGMP, ...)	Layer 3 switching
X414-3E	2 [3]	12				4 [1]	4 [2]		■	■	■	■	■	■	■ [4]	■	■	■	■		■	■	8	■	■
X202-2IRT		2				2		■	■	■	■	■	■	■	■	■	■	■	■	■					
X204IRT		4						■	■	■	■	■	■	■	■	■	■	■	■	■					
X208		8						■	■	■	■	■	■	■	■	■	■								
X206-1		6				1		■	■	■	■	■	■	■	■	■	■								
X206-1LD		6					1	■	■	■	■	■	■	■	■	■	■								
X204-2		4				2		■	■	■	■	■	■	■	■	■	■								
X204-2LD		4					2	■	■	■	■	■	■	■	■	■	■								
X208PRO			8					■	■	■	■	■	■	■	■	■	■								
X108		8						■	■	■	■	■	■												
X106-1		6				1		■	■	■	■	■	■												
X104-2		4				2		■	■	■	■	■	■												
X005		5						■	■	■															
OSM TP22		2				2		■	■	■	■	■	■	■		■		■					4		
OSM TP62		6				2		■	■	■	■	■	■	■		■		■	■				8		
OSM ITP62					6	2		■	■	■	■	■	■	■		■		■	■				8		
OSM ITP53					5	3		■	■	■	■	■	■	■		■		■	■				8		
OSM ITP62-LD					6		2	■	■	■	■	■	■	■		■		■	■				8		
OSM BC08						8		■	■	■	■	■	■	■		■		■	■				8		
ESM TP40		4						■	■	■	■	■	■	■		■		■					4		
ESM TP80		8						■	■	■	■	■	■	■		■		■	■				8		
ESM ITP80					8			■	■	■	■	■	■	■		■		■	■				8		
ELS TP40		2		2				■	■	■															
ELS TP40M		2		2				■	■	■				■											
ELS TP80		8						■	■	■															

[1] can be additionally plugged in via 2 multimode media modules
[2] can be additionally plugged in via 2 singlemode media module
[1] and [2] a total of max. 2 media modules 100 Mbit/s can be plugged in

[3] FO via gigabit media module
[4] available soon

■ suitable
not suitable

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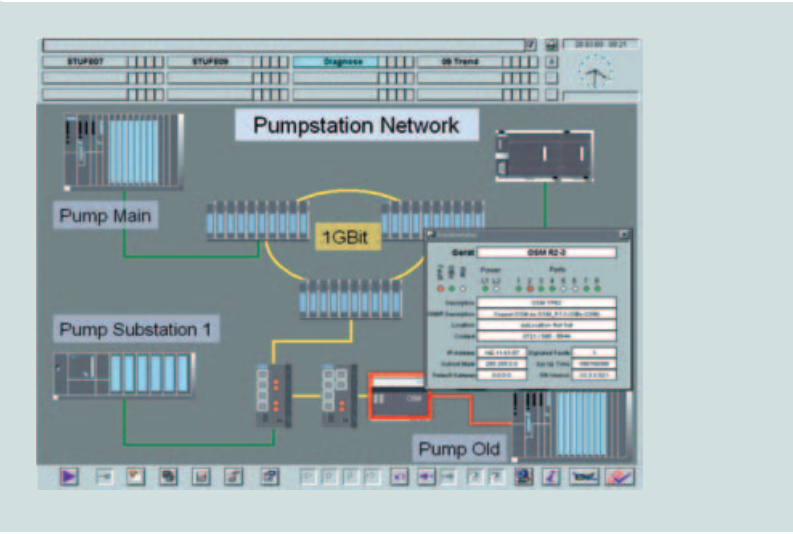
Active network components
Diagnostics and network management

The Industrial Ethernet Switches SCALANCE X005, X-100, X-200, X-200IRT, X-400, OSM and ESM have the following diagnostic functions:

- LED displays;
  LEDs display information locally about power, port status and data traffic.
- Error signal contact;
  isolated error signal contact facilitates signaling of link traffic. This enables, for example, the module to be monitored via an input module from a controller.
- Signal screen form for error signal contact;
  the signal screen form is set to the current status of the switch (setpoint) by pushbutton operation.
  It defines which ports and which voltage feeds are to be monitored. The signal contact only reports an error when a monitored port or a monitored feeder fails (deviation of setpoint/actual status).
- PROFINET diagnostics;
  PROFINET diagnostic alarms from SCALANCE X-200 and SCALANCE X-400 (available soon) can be displayed with STEP 7 and also processed in the controller.
  By means of complete integration into the SIMATIC concept for system error messages, the engineering overhead for PLC and HMI is reduced.
- Web-based Management;
  The integral Web server enables configuration and diagnosis settings to be made using a standard browser. Statistical information can also be read out over the Web server.



Network monitoring of a pumping station with SNMP OPC server

- Standard diagnosis via SNMP (Simple Network Management Protocol);
  By means of SNMP, the SCALANCE X-200, SCALANCE X-400 switches and OSM/ESM can be monitored on any network management systems and with the aid of the SNMP OPC servers even in HMI systems.
  If faults occur on the device, error messages (SNMP traps) can be sent to a network management system or as e-mail to a specified network administrator.
- VLANs (Virtual LANs)
- IGMP Snooping/Querier
- RSTP (Rapid Spanning Tree)
- Multicast/Broadcast limitation
- Layer3 (IP routing)

	Possibilities of diagnostics with switches										
Module type	LED	Error signal contact	Signal screen form	PROFINET diagnosis	Web-based management	Diagnosis via SNMP	VLAN	IGMP-Snooping/-Querier	RSTP	Multicast-/Broadcast-limitation	Layer 3 (IP routing)
SCALANCE X414-3E	■	■	■	avail. soon	■	■	■	■	■	■	■
SCALANCE X-200/X-200IRT	■	■	■	■	■	■					
SCALANCE X-100	■	■	■								
SCALANCE X005	■										
OSM	■	■	■		■	■					
ESM	■	■	■		■	■					

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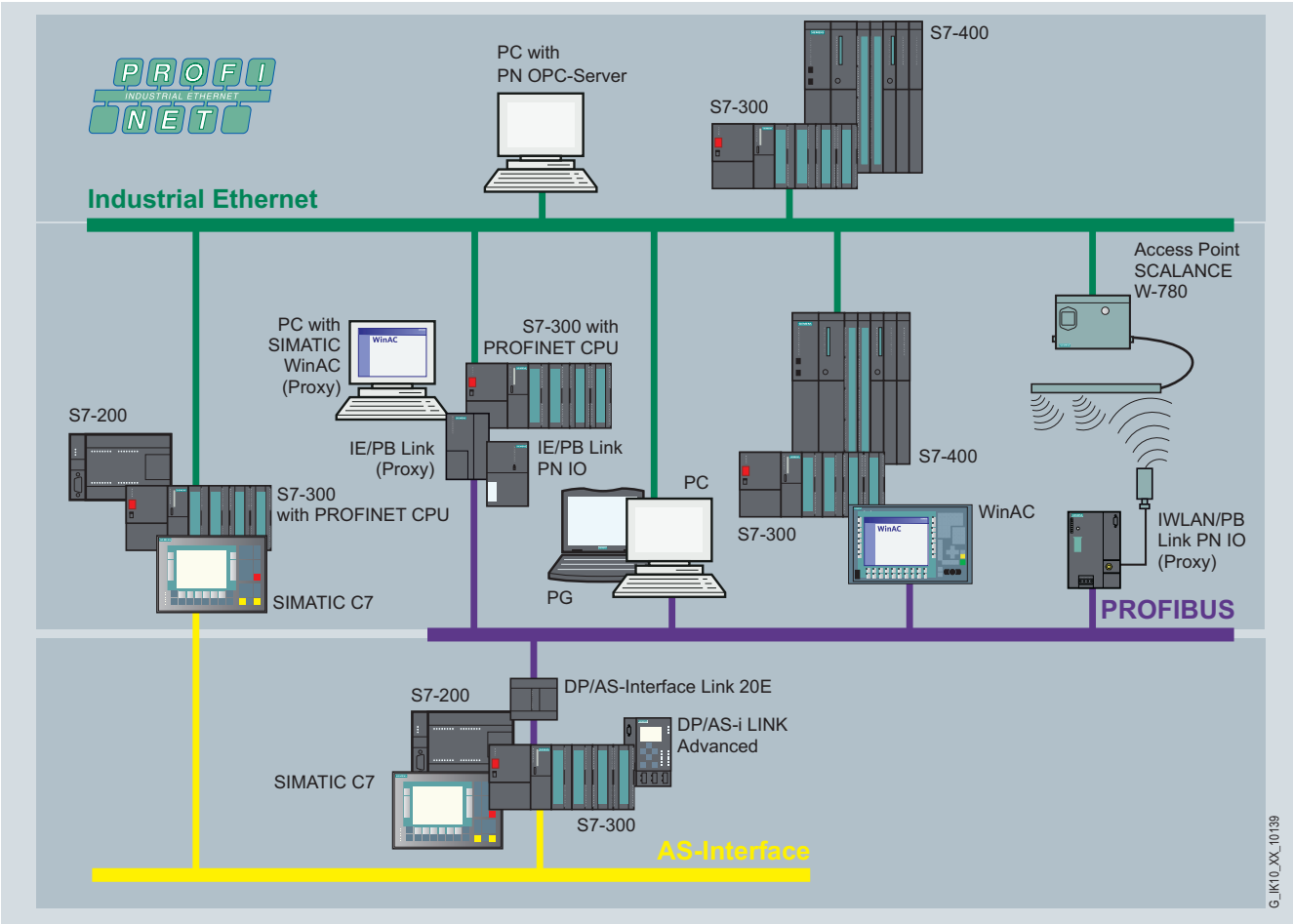
Routers



Routers between Industrial Ethernet, PROFIBUS, AS-Interface or KNX/EIB are implemented via links, controllers (PLCs) or PCs. In the case of controllers or PCs, this takes place via integrated interfaces and communication processors (CPs).
If the network transition takes place via a link, the data is forwarded from one network to the other without any further links.

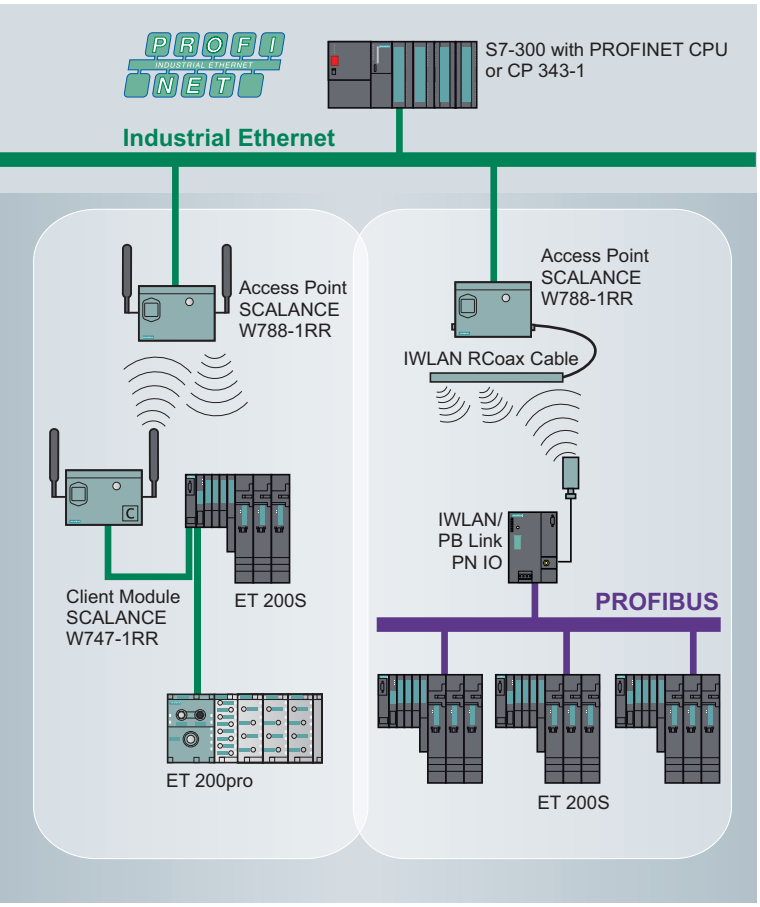
Links are independent components that form the seamless transition between the various bus systems, e.g. between Industrial Ethernet and PROFIBUS. For example,
HMI systems can gain easy access from Industrial Ethernet to field devices on the PROFIBUS or on the AS-Interface.

This allows vertical integration from the management level down to the field level.

The following links are available:

- **IE/PB Link and IE/PB Link PN IO**
  for the transition to from Industrial Ethernet to PROFIBUS
- **IWLAN/PB Link PN IO**
  for the transition from IWLAN to PROFIBUS
- **DP/AS-i LINK Advanced and DP/AS Interface Link 20E**
  for the transition from PROFIBUS to AS-Interface

Industrial Mobile Communication



The key to future market success lies in the ability to provide information and access to information at any time and in any location.

With mobile systems interconnected via fast wireless data networks (Wireless LAN), processes can become more efficient. The main advantage of wireless solutions is easy and flexible access to mobile stations. Industrial Mobile Communication (IMC) plays an important role in this: IMC stands for mobility with industrial communication products of SIMATIC NET that utilize wireless communication. This is based on worldwide standards, such as IEEE 802.11, GSM, GPRS or, in the future, UMTS.

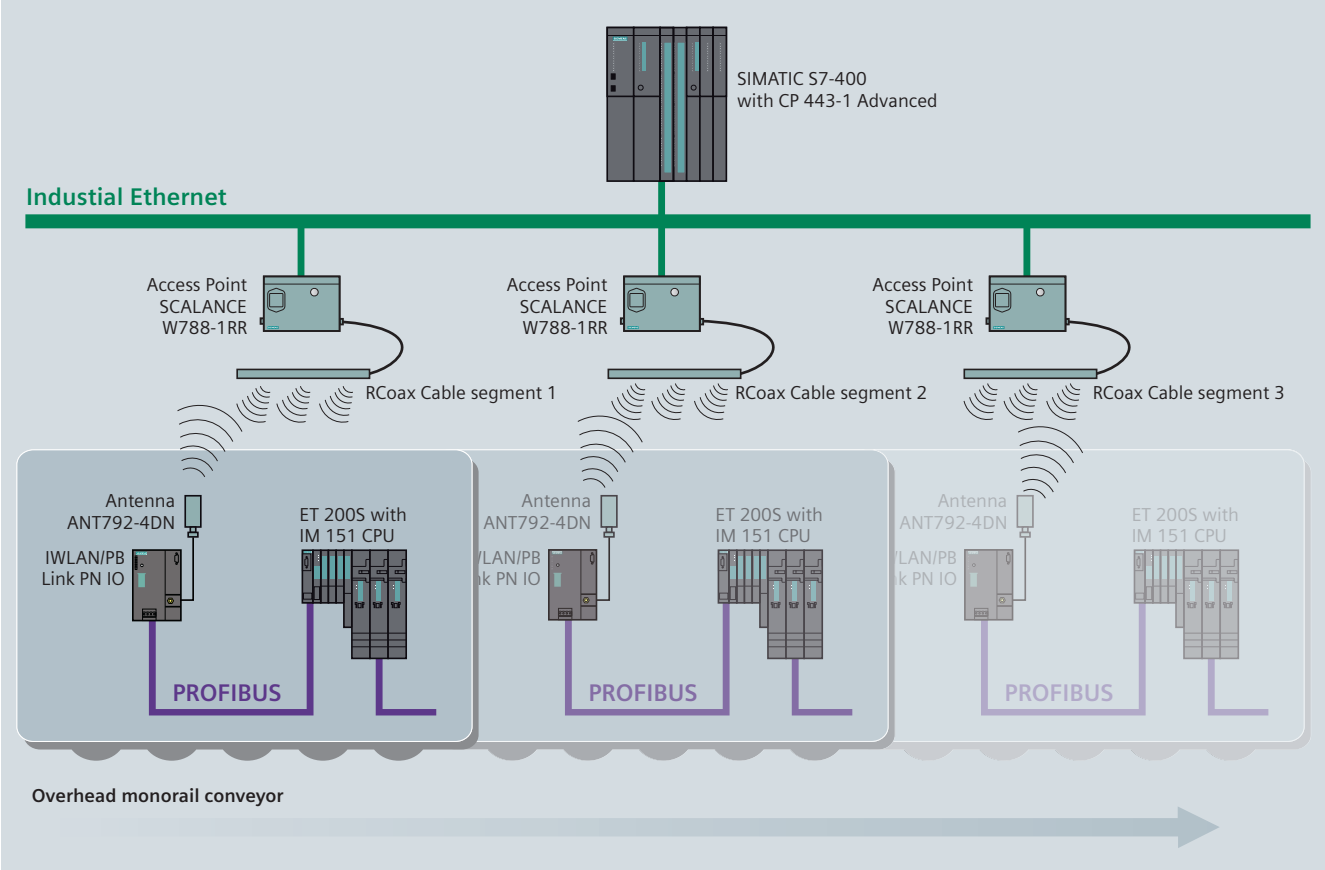
Failsafe wireless communication via IWLAN is also possible.

Advantages of a wireless communication network

- Increased competitiveness, since greater flexibility is achieved through mobility
- Maintenance work is simplified, service costs and downtimes are reduced, and personnel are used optimally
- Spare parts lists and manuals are accessible regardless of location
- Work orders can be received and acknowledged online
- The system solution is tested and well-proven because the network components, communications processors, and software are perfectly matched to each other
- Remote diagnostics for different production machines from a central service location reduces service costs
- Awkwardly located installations can be accessed easily; there is no need for complex wiring
- Fast commissioning of new plant items due to reduced amount of work for installing the communication network
- No wear and tear of rotating and moving equipment or system components
- Cost-effective connection to devices which are remote, difficult to access or in hostile environments.

SCALANCE W – wireless communication

The SCALANCE W products offer a unique combination of reliability, ruggedness and safety in one product.
With Industrial Wireless LAN (IWLAN), an extension to the IEEE 802.11 standard is made available that addresses the requirements of industrial customers in particular with regard to a deterministic response and redundancy. For the first time, this gives customers a single radio network not only for process-critical data (e.g. alarm message), but also for non-critical communication (e.g. service and diagnosis).
The IWLAN components SCALANCE W and PROFINET together with the Industrial Ethernet Standard provide a mobile solution for new applications right down to the the field level.
The reliability of the radio channel is reflected in the dust- and waterproof design (IP65) of the metal enclosure, with the high demands on mechanical stability familiar from SIMATIC.
To protect against unauthorized access, the products provide modern standard mechanisms for user identification (authentication) and encryption of data, but can also be easily integrated in existing security systems. The "Rapid Roaming" function is available for the fast handover of mobile stations between different access points.



Application examples

- **Overhead monorail conveyors**
- **Automated guided vehicles (AGV)**
- **Cranes**
- **Stacker cranes**
- **Transfer lines**
- **Tool-changing trolleys**
- **Robots**
- **Railway stations**
- **Underground railway systems**
- **Railway wagons**
- **Lifts**
- **Theater stages**

Network components for IWLAN

- IWLAN RCoax cables
- IWLAN/PB Link PN IO
- SCALANCE W-700
- Accessories:
  - Antennas
  - Termination impedance
  - Lightning protector
  - Power supply

Possible applications of the leaky wave cable RCoax Cable

- Areas that are difficult to serve with radio (e.g. tunnels, channels and elevator shafts), where a non-wearing and secure solution for the transmission of data is important.. To this end, the transmission power is guided at a defined level along the RCoax cable.
- Applications, in which a high value is placed on a non-wearing and reliable radio connection with controlled and limited propagation of the transmission power, in order to increase the data security (e.g. conveyor systems, robots and every type of rail-guided vehicle). In modern production areas in which radio communication is used in production, therefore, transmission frequencies as well as power/location are managed very precisely.

Products for wireless communication

The following products are used with SIMATIC NET for mobile communication in automation solutions:

- Access Points
  SCALANCE W788-1PRO/W788-2PRO and
  SCALANCE W788-1RR/W788-2RR

Comprehensive WLAN solutions in the office and production area can be implemented together with the Access Point SCALANCE W788-2RR and HiPath Wireless. This enables mobile controllers, wireless operation and monitoring and WLAN telephony to be operated with OptiPoint telephones in a single radio network.

- Communication processor CP 7515, e.g. for Field PG
- Client Modules
  SCALANCE W744-1PRO, SCALANCE W746-1PRO and
  SCALANCE W747-1RR
- IWLAN/PB Link PN IO router
- IWLAN RCoax cables
- Accessories

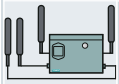
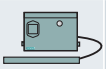
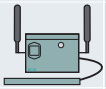
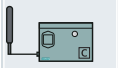
These products permit a particularly reliable radio connection and are very ruggedly constructed. The housing is therefore splash-proof and dustproof with a high degree of resistance to vibration.

A radio-based solution with the IWLAN/PB Link PN IO is available for wireless communication in the PROFIBUS environment.

This means that information can be provided quickly, reliably and easily at the right place and at the right time with flexibility and mobility.

The radio link with IWLAN is of such high quality that even the real-time requirements of PROFINET IO and strict real-time requirements are met – even in the demanding industrial environment.

Function overview

		Access Point	Client	HiPath Wireless Controller	Number of radio interfaces	802.11b (2,4 GHz, 11 Mbit/s)	802.11g (2,4 GHz, 54 Mbit/s)	802.11a (5 GHz, 54 Mbit/s)	AES (Advanced Encription Security)	WPA (Wi-Fi Protected Access)	WEP (Wired Equivalent Privacy)	Antenna diversity	External antenna can be connected [2]	WDS (Wireless Distribution System)	PoE (Power over Ethernet) 802.3af	PoE (Power over Ethernet) 24V	Redundant power supply	Wall mounting	S7 rail	Standard DIN rail	IP degree of protection	-20°C to +60°C	0°C to +40°C	Resistant to condensation	Metal enclosure	Reservation of data transfer rate	Rapid roaming	Address table		Hardwired interface
																											Number of addresses	Address administration	
	SCALANCE W788-1PRO	■	■ [1]		1	■	■	■	■	■	■	■	■	■	■	■	■	■	■		65	■	■	■	■	■		2048	IP or MAC adr.	IE
	SCALANCE W788-2PRO	■	■ [1]		2	■	■	■	■	■	■	■	■	■	■	■	■	■	■		65	■	■	■	■	■		2048	IP or MAC adr.	IE
	SCALANCE W788-1RR	■	■ [1]		1	■	■	■	■	■	■	■	■	■	■	■	■	■	■		65	■	■	■	■	■	■	2048	IP or MAC adr.	IE
	SCALANCE W788-2RR	■	■ [1]	■	2	■	■	■	■	■	■	■	■	■	■	■	■	■	■		65	■	■	■	■	■	■	2048	IP or MAC adr.	IE
	SCALANCE W744-1PRO		■	■	1	■	■	■	■	■	■	■	■		■	■	■	■	■		65	■	■	■	■	■		1	1x MAC adress	IE
	SCALANCE W746-1PRO		■	■	1	■	■	■	■	■	■	■	■		■	■	■	■	■		65	■	■	■	■	■		8	7x IP, 1x MAC adr.	IE
	SCALANCE W747-1RR		■	■	1	■	■	■	■	■	■	■	■		■	■	■	■	■		65	■	■	■	■	■	■	8	7x IP, 1x MAC adr.	IE
																											Number of devices		
	IWLAN/PB Link PN IO		■	■	1	■	■	■	■		■		■				■			■	20	[3]	■			■	■	8 PROFIBUS Slaves		PB Master
	CP 7515		■	■	1	■	■	■	■	■	■	■								■	20		■		■	■				PC Card (32 Bit)

[1] Client function through alternative parameters
[2] e.g. RCoax Cable
[3] 0°C to +60°C

■ suitable
not suitable

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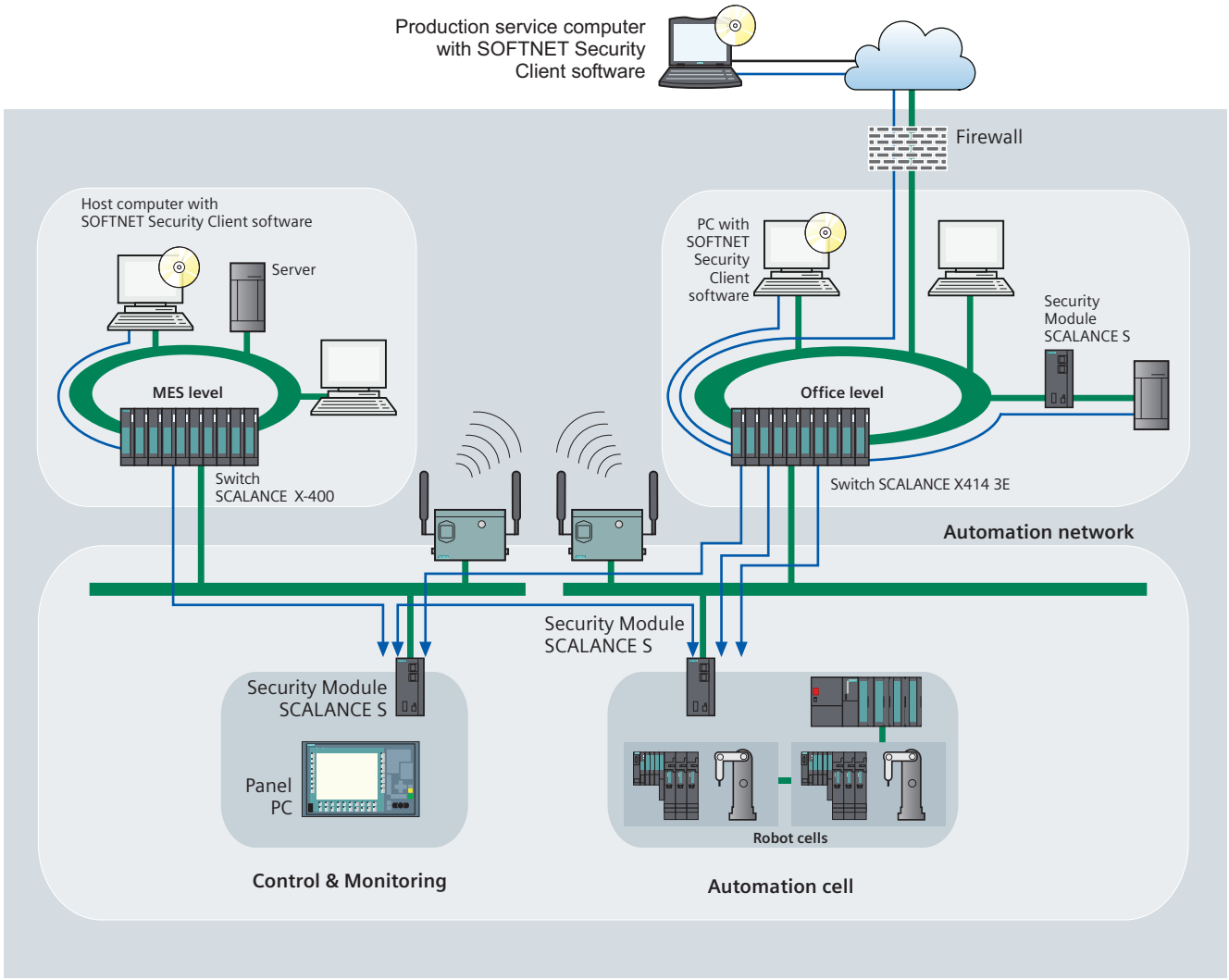
Industrial security for automation networks



Modern automation technology is based on communication and the trend toward increased networking of individual manufacturing islands. It is becoming more and more important to integrate all the manufacturing components into a uniform network that merges with the office network and the corporate intranet.

- Remote access options only for service purposes
- Increasing use of IT mechanisms such as Web server and e-mail for programmable logic controllers
- Use of Wireless LANs

In this manner, industrial communication interacts increasingly with the IT environment and is now subjected to the same dangers that are well-known from the office and IT environment, such as hackers, viruses, worms and Trojan horses.

With its industrial security concept, Siemens offers a safety solution specially designed for industrial automation engineering that satisfies the specific requirements of this application environment.

Security modules and SOFTNET Security Client

SCALANCE S612 and SCALANCE S613 security modules

Security modules of the SCALANCE S family are provided specially for use in automation applications, yet connect seamlessly with the security structures of the office and IT world.

The security modules protect PLCs from espionage, manipulation and unauthorized access and safeguard the data exchange between individual devices or entire network segments (e.g. automation cells).

SCALANCE S security modules offer a scaleable security functionality:

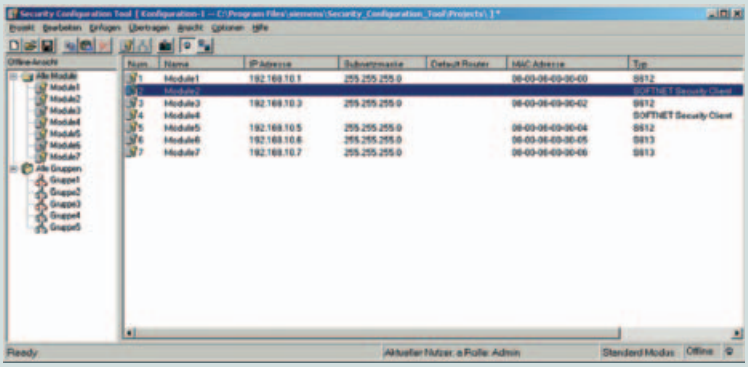
- Firewall for protecting the programmable controllers from unauthorized access regardless of the size of the network to be protected.
- Supplementary or alternative VPN (Virtual Private Network) for reliable authentication of the communication partners and encryption of the transmitted data

SOFTNET Security Client

The software sets up secure IP-based VPN connections from PC/PG with network segments.

The SOFTNET Security Client allows programming devices, PCs and notebook computers access to network nodes or automation systems protected by SCALANCE S.

Simple configuration via the Security Configuration Tool



Advantages of the SCALANCE S security concept

- **Protection from espionage and data manipulation**
- **Protection against overloading of the communication system**
- **Protection against mutual interference**
- **Protection against addressing mistakes**
- **User-friendly and simple configuration and administration without specialist knowledge of IT security**
- **No changes or modification of the existing network structure are necessary**
- **No changes or modification of the existing applications or network stations are necessary**
- **Rugged, industry-compatible design**

Communication processors for SIMATIC
SIMATIC S7

The communication processors of SIMATIC NET can be used for applications in the field area, in process automation or for wireless communication.

Effectiveness and efficiency are essential in the case of solution concepts for plant components of automation tasks. This means that very high demands are imposed on the communication performance with regard to data rates.

Thanks to their protocol preprocessing, the communication processors offer a constant data throughput. At a stable high level, they implement fast response times and rule out any fluctuations in communication performance.

The CPs perform communication tasks for the terminals and take up few of their resources.

PLC – central element of communication

Programmable logic controllers (PLCs) are of key importance in the world of automation. And industrial communication forms the nerve center in this respect. SIMATIC NET PLC-CPs adopt a key role in industrial communication.

They offer the following advantages:

- CPs for all formats of SIMATIC, e.g. SIMATIC S7-200/-300/-400.
- By means of open communication with standards, SIMATIC can communicate with any other device.

SIMATIC NET increases availability by means of modular, networked subsystems, as in the case of electrical supply, which also takes place in individual circuits.

SIMATIC S7 controllers can be integrated via the standard protocols TCP/IP, HTTP, SMTP and FTP into higher-level software systems such as MES (Manufacturing Execution System) and MIS (Management Information System).

This can be done even more simply using the SIMATIC NET products for Windows PCs that offer an OPC interface and are integrated into the engineering of SIMATIC.

Communication processors for SIMATIC S7

SIMATIC S7

For the connection to SIMATIC S7 there are various communication processors whose design is adapted to the respective target system – SIMATIC S7-200, SIMATIC S7-300 or SIMATIC S7-400.

Standard processors for SIMATIC S7 are:

- CP 243-1 for SIMATIC S7-200
- CP 343-1 Lean and CP 343-1 for SIMATIC S7-300
- CP 443-1 for SIMATIC S7-400

The communication processors are all designed for use in tough industrial environments with a wide range of temperatures. They are certified for marine use (ABS), enabling them to be used in ships or offshore installations. The CPs are integrated into the industry-standard cabling system of SIMATIC NET via the RJ45 interface. With data transfer rates of 10 Mbit/s and 100 Mbit/s, the fast transmission even of high volumes of data is possible. The CPs have S7 communication as standard.

Apart from the standard processors, SIMATIC NET also offers communication processors with extended functions:

- CP 243-1 IT with IT functionality
- CP 343-1 Advanced with IT functionality for use as PROFINET IO controller
- CP 443-1 Advanced with IT functionality, for use as PROFINET IO controller; this has a 4-port switch for setting up small local networks.

CPs for S7-200

The CPs for the SIMATIC S7-200 – CP 243-1 and CP 243-1 IT – can communicate with as many as eight links to other Industrial Ethernet nodes and can optionally be clients or servers. PC applications can access the data of an S7-200 with CP 243-1 and CP 243-1 IT via the standardized, open and vendor-independent OPC interface. For data access, the SOFTNET S7 software package is required. In this way, process data can be visualized, archived or processed on a PC, e.g. using PC applications such as OPC, WinCC, WinCC flexible or WinAC.

CPs for S7-300 and S7-400

CP 343-1 Lean, CP 343-1 and CP 343-1 Advanced for the connection of the SIMATIC S7-300, and CP 443-1 and CP 443-1 Advanced for the connection of the SIMATIC S7-400 feature autosensing (10/100 Mbit/s) with HDX (Half Duplex) and FDX (Full Duplex) connection for the automatic recognition of operating modes. They offer universal connection options, such as ISO, TCP and UDP transport protocols and can be used in some cases for PROFINET communication.

CPs for S7-200

CP 243-1

CPs for S7-300

CP 343-1

CPs for S7-400

CP 443-1

The additional communication services such as PG/OP communication and S5-compatible communication (SEND/RECEIVE) complete the range of applications in the industrial environment.

The Industrial Ethernet communication processors for SIMATIC S7-300/S7-400 offer the following advantages:

- Investment protection for existing plants through the integration of the SIMATIC S7-300/S7-400 by means of S5-compatible communication
- Security: Protection without the need for changing passwords, thanks to device-oriented IP address lists
- Remote programming is possible due to the WAN characteristic of TCP/IP, even via the telephone network (e.g. ISDN)
- Setting of intrinsic IP parameters of series machines without STEP 7
- Plant-wide time synchronization via NTP or SIMATIC procedure
- Accessibility of many nodes by means of free UDP connections or multicast function
- Active transmission of data with S7 communication
- Access by as many as 16 HMI systems to the SIMATIC S7-300/S7-400
- Use of the socket interface in the partner system possible without RFC 1006
- Module replacement without the need for the PG; all information is stored on the C-PLUG

Some CPs differ in the construction or functionality of the standard communication processors.

CP 343-1 Lean

The CP 343-1 Lean is a single-width unit and thus saves installation space in the control cabinet. It enables SIMATIC S7-300 to access as many as four HMI systems.

CP 343-1 Lean

CP 343-1 Advanced

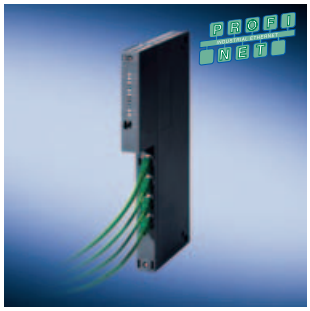
CP 343-1 Advanced and CP 443-1 Advanced

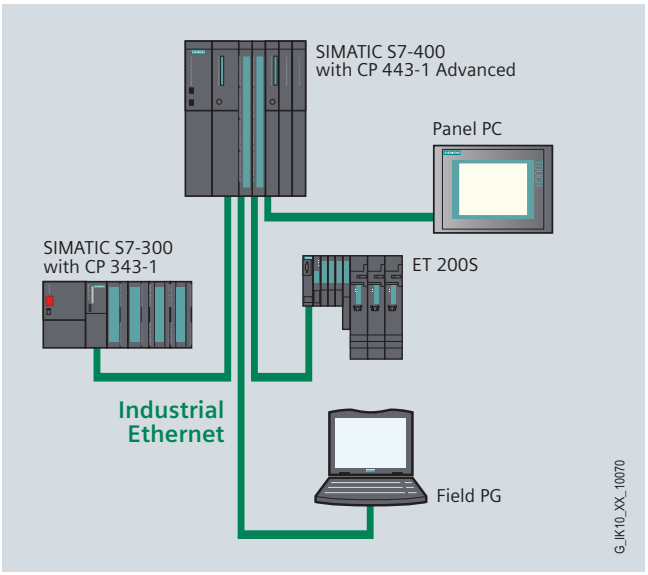
- Connection of field devices to Industrial Ethernet with PROFINET; so that real-time communication is possible right down to the field level.
- Savings in time and cost in modular machine and plant construction with PROFINET CBA
- Local and worldwide transmission of event-driven messages by e-mail through IT communication paths
- Simple visualization via Web browser
- File processing (FTP): The CPs are used as universal data links from the PLCs to various computers via FTP
- Process information can be accessed (password protected) with standard Web browsers, which reduces software costs on the client side

The file system of the CP 343-1 Advanced/CP 443-1 Advanced can also be managed through the CPU. This serves as a bulk storage device, a cross-system computer link and a storage for HTML pages and Java applets or also for storing machine documentation or user help files.

Additionally for CP 443-1 Advanced

- Integrated 4-port switch with RJ45 connections permits the construction of small local networks, e.g. within a machine or cell. This saves space in the control cabinet.





Small independent local networks with S7-400 and CP 443-1 Advanced

SIMATIC S7 und SINAUT ST7
Overview of functions

	Hardware	Transport protocol			PG/ OP*	S7 communication						PROFINET Controller		S5-comp. communic.		IT 2)	FTP	TF	Time of day			
		ISO	TCP	UDP		Put/Get Client	Put/Get Server	BSEND BRECV	USEND URECV	SINAUT ST7	H communication	IO	CBA	SEND/RECEIVE	Fetch/Write				Sender (master)	Reciever	Forward	with NTP
SIMATIC S7-200	CP 243-1		■		■	■	■															
	CP 243-1 IT		■		■	■	■									■	■					
SIMATIC S7-300/C7	CP 343-1 Lean		■	■	■		■							■	■ 4)					■		
	CP 343-1	■	■	■	■	■	■	■	■			■		■	■ 4)							■
	CP 343-1 Advanced	■	■		■	■	■	■	■			■		■	■ 4)	■	■			■		■
	TIM 3 V-IE				■					■												
	TIM 3 V-IE Advanced				■					■												
SIMATIC S7-400	CP 443-1	■	■	■	■	■	■	■	■		■ 1)			■	■				■ 3)	■	■	■
	CP 443-1 Advanced	■	■		■	■	■	■	■			■	■	■	■	■	■		■ 3)	■	■	■
SIMATIC S5	CP 1430 Basic	■			■									■	■			■	■			
	CP 1430 Ext.	■			■									■	■			■	■			
	CP 1430 TCP		■		■									■	■							

■ suited

not suited

1) ISO protocol only
2) IT functionality included in IT-CP
3) If CPU is the time-of-day master
4) without client function

*) PG/OP communication

G_IK10_XX_10057

Remote control and remote maintenance
SINAUT

SINAUT ST7 is an innovative and versatile telecontrol system based on SIMATIC S7 for the fully-automatic monitoring and control of process terminals which exchange data with one or more control centers or with each other via a WAN or Ethernet (TCP/IP) network).

SINAUT facilitates an integrated communications concept (TIA) and complete integration into the SIMATIC environment. Both the modular design and the support of a huge variety of network forms and operating modes, including Ethernet, ensure very flexible network structures that can also contain redundant links.

By using all forms of transmission media (e.g. dedicated line, radio, dial-up networks, text messages, fax), the networks can be optimally adapted to the respective local conditions.

The first-time configuration even of extremely complex networks and their expansions can be performed easily and cost effectively by using the software packages supplied.

The control center

The following are available as a control centers:

- SIMATIC S7-300 or S7-400 controllers
- SINAUT ST7cc, the PC control center (single or redundant) based on WinCC;
  This is a control center specially adapted to the event-controlled and time-stamped data transmission of the SINAUT system.
- SINAUT ST7sc, for interfacing control centers from other vendors via OPC;
  the SINAUT telecontrol technology can also be interfaced with control center systems from other vendors via the "Data Access Interface". ST7sc features extensive buffer mechanisms which prevent data from being lost, e.g. if the OPC client fails.

SINAUT WANs

- Dedicated lines (copper and fiber optic cables)
- Private radio networks (optionally with time slot procedure)
- Analog telephone network
- Digital ISDN network
- Mobile radio network (GSM)
- DSL network

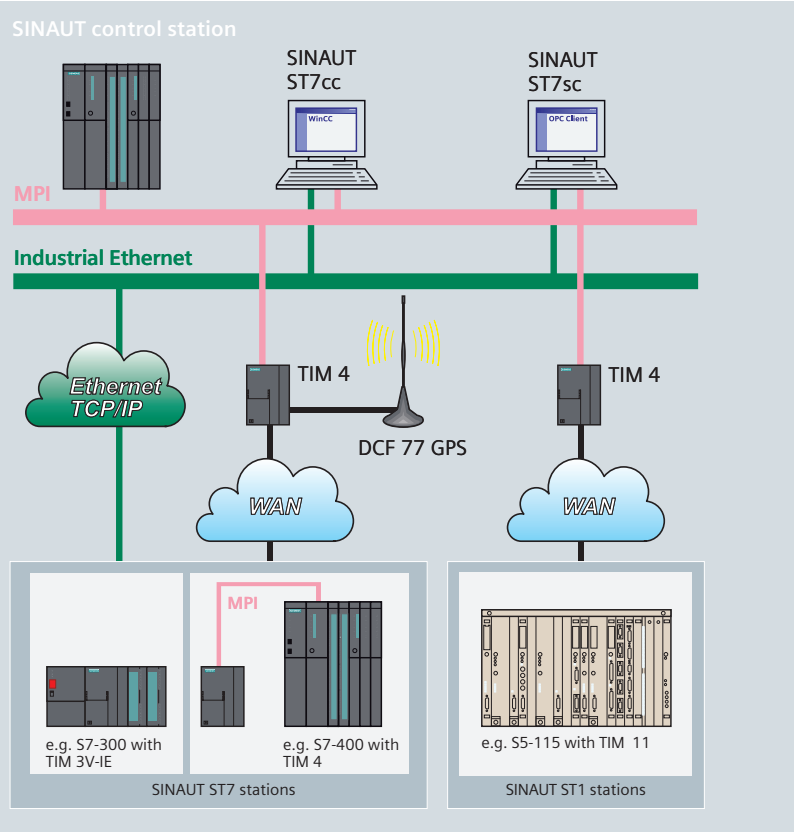
All networks can be combined as required. Redundant paths are also possible. Star, line and node structures can be set up.

SINAUT via Ethernet

SINAUT communication via the Ethernet on TCP/IP-based networks is possible between station and control center and also between individual stations. The prerequisites are fixed IP addresses and connections similar to dedicated lines.

SINAUT remote programming and remote diagnostics

All diagnostics and programming functions provided by SIMATIC and SINAUT for station automation and SINAUT communication can be used beyond the SINAUT networks - without interrupting process data transmission.



SINAUT TIM communication modules

The TIM (**T**elecontrol **I**nterface **M**odule) is a central component of the SINAUT hardware. It is used by the S7 CPU or control center PC for data exchange via the WAN, based on either the SINAUT ST7 or SINAUT ST1 protocol.

TIM 3

TIM 3 is the SINAUT communication module for the SIMATIC S7-300 and has one WAN interface.

On the most basic version of TIM 3, this is a serial interface to which an appropriate external modem can be connected. On three other TIM 3 versions, the WAN interface is implemented via the built-in modem.

The connection to Industrial Ethernet can be implemented via the TIM 3V-IE or TIM 3V-IE Advanced.

SINAUT TIM 3 communication module

TIM 4

TIM 4 is suitable for

- installation as a communication processor (CP) in S7-300, but also
- as an independent device, connectable via MPI to one or more S7-400s and S7-300s
- connection to the PC control centers ST7cc or ST7sc .

TIM 4 has two WAN interfaces (except TIM 4V, which only has one).

On the most basic TIM 4 module, these are two serial interfaces. To each interface an appropriate external modem can be connected.

On three other TIM 4 versions, the first WAN interface is implemented via the built-in modem and the second via the additional serial interface.

The two WANs which can be connected to a TIM 4 may be of the same type or different types, e.g. dedicated line plus telephone network.

The TIM 4 can also be fitted with a DCF77 radio clock receiver as an option.

SINAUT TIM 4 communication module

Communication processors for PG/PC

For the implementation of flexible production PCs and programming devices (PGs) are becoming increasingly important in addition to programmable logic controllers (PLCs) in the industrial sector.

Thanks to their flexible programming capability, quick adaptation of the production system to the automation task is possible.

With powerful communication structures, automation projects today can be implemented economically and with the necessary flexibility.

PC as an element of communication

The PC is assuming a key role in industrial communication and in the control of real-time applications.

PC applications are often used for tasks that otherwise can only be performed by a PLC. In addition, it forms an ideal basis for a central visualization of HMI systems, such as WinCC or WinCC flexible.

The SIMATIC NET PC communication processors offer the following solutions:

- CPs in various formats for PCI, PCMCIA, PC/104 Plus or PC Card format
- They can be used flexibly; depending on the demand for resources in the PC, CPs are available with or without their own microprocessor
- Open and standardized interfaces, e.g. with the OPC server, that permit simple integration into the system environment and office applications.

Note
The necessary configuration tools for the SIMATIC NET communication processors for PGs/PCs are included in all software packages. The software that runs under Windows can be found on the SIMATIC NET/Windows CD, including the associated manuals in PDF format and comprehensive additional information on SIMATIC NET products and communication.

Communication processors for PG/PC

System		Hardware	Software packages	Description
SIMATIC PC		CP 1613 A2	S7-1613 PG-1613	Up to 120 nodes
		CP 1616 CP 1604	DK-16xx PN IO	For PROFINET applications with real-time and isochronous real-time (available soon)
		CP 1612 CP 7515	SOFTNET-S7 for Industrial Ethernet SOFTNET PN IO	Up to 64 nodes
PG applications		CP 1613 A2 CP 1616 CP 1604	STEP 7/NCM S7 NCM PC PG-1613	For parameterization of the existing system with SIMATIC S7 and PC stations
		CP 1612 CP 7515	STEP 7/NCM S7 NCM PC SOFTNET-PG SOFTNET PN IO	For parameterization of S7-CPs; mobile parameterization with CP 7515

System connection for PG/PC

Communication processors with microprocessor

- Constant data throughput through protocol processing on the CP, even for extensive applications
- The CPs can be connected to any Ethernet networks by means of AUI/ITP and/or RJ45 ports on the module
- They create free computing capacity for other applications on the PC e.g. HMI (ISO and TCP/IP transport onboard)
- The CPs are easy to use, thanks to Plug&Play and Auto-sensing (10/100 Mbit/s)
- The operation of large network configurations with a single card is supported by a high number of connections
- The CPs can be used for redundant communication
- OPC (included in the software packages) is used as a standard interface
- Uniform operation and configuration functions for NCM PC and STEP 7
- The CPs are designed for use in the industrial environment
- CP 1616 and CP 1604 are suitable for PROFINET IO applications in real-time (RT) and isochronous real-time (available soon)

Communication processors with their own microprocessor

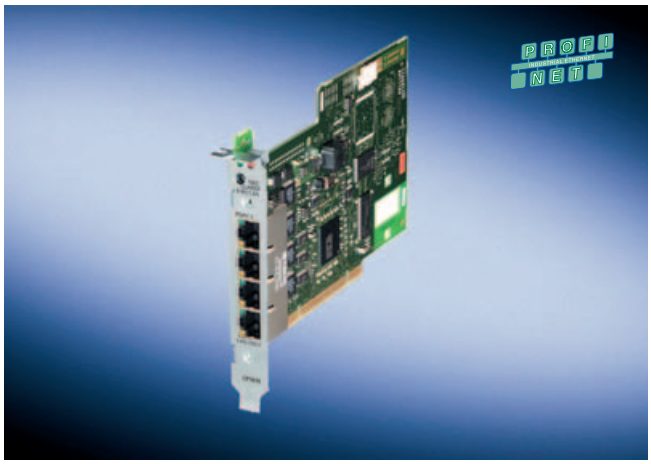
CP 1616

The CP 1616 is a PCI module used for connecting PCs and SIMATIC PGs/PCs to PROFINET IO. Local networks can be set up via the 4-port real-time switch. Direct memory access to process data is possible by linking as PROFINET IO controller via IO base interface By means of the Real-Time ASIC ERTEC 400 with support of the PROFINET real-time properties RT and IRT (available soon), the burden on the host CPU is reduced and the computing power of the PCs is increased.

Using the CP 1616, PROFINET-compatible field devices can be connected to Industrial Ethernet.

The CP 1616 supports the following communication services:

- PROFINET IO controller and/or PROFINET IO device (RT)
- IRT for motion control applications (available soon)



CP 1616

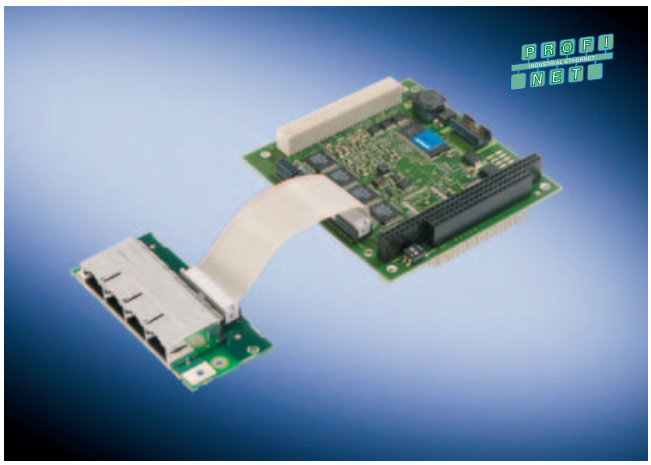
CP 1604

The CP 1604 is a PC/104-Plus module for connecting PC/104-Plus systems to PROFINET IO Small local networks in particular can be set up via the 4-port real-time switch. Direct memory access to process data is possible by linking as PROFINET IO controller via IO base interface By means of the Real-Time ASIC ERTEC 400 with support of the PROFINET real-time properties RT and IRT (available soon), the burden on the host CPU is reduced and the computing power of the PCs is increased.

Using the CP 1604, PROFINET-compatible field devices can be connected to Industrial Ethernet.

The CP 1604 supports the following communication services:

- PROFINET IO controller and/or PROFINET IO device (RT)
- IRT for motion control applications (available soon)



CP 1604

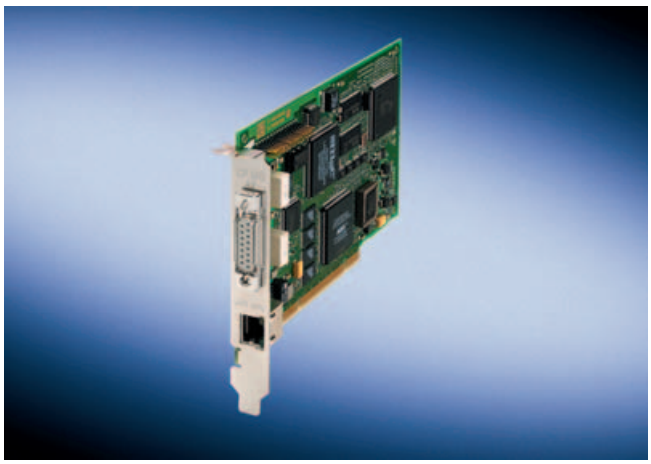
CP 1613 A2

The CP 1613 A2 is a PCI module (32 bit; 33 MHz/ 66 MHz; 3.3 V/5 V universal key) for connection of PG/PC to Industrial Ethernet with 10/100 Mbit/s Autosensing

Thanks to the 15-pin ITP or RJ45 connection on the module, the CP 1613 A2 offers numerous connection options. It permits network-wide clock synchronization.

The CP 1613 A2 supports the following communication services in connection with the corresponding software:

- ISO and TCP/IP transport protocol
- PG/OP communication
- S7 communication
- S5-compatible communication (SEND/RECEIVE)

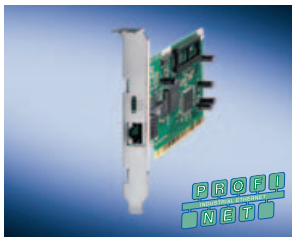


CP 1613 A2

Communications processors without an internal microprocessor

- The CPs are ideally coordinated to the SOFTNET software packages for Industrial Ethernet and designed for use in industrial environments
- Particularly suitable for smaller systems (up to 8 stations, e.g. SIMATIC)
- OPC (included in the software packages) is used as a standard interface
- Uniform operation and configuration functions for NCM PC and STEP 7
- In PGs/Notebooks with STEP 7 they permit remote maintenance and diagnostics via Ethernet
- CP 7515 is integrated into the Field PG for wireless communication compliant with IEEE 802.11a/b/g

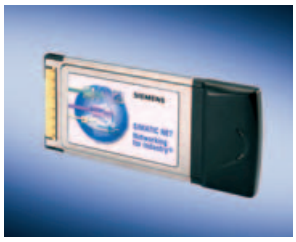
CP 1612



The CP 1612 is a PCI card (32 bit; Universal Key 3.3 V/5 V) for the connection of PGs/PCs to Industrial Ethernet via RJ45 interfaces (twisted pair)
The CP 1612 supports the following communication services:

- ISO and TCP/IP transport protocols
- PG/OP communication
- S7 communication
- S5-compatible communication (SEND/RECEIVE)
- PROFINET communication

CP 7515

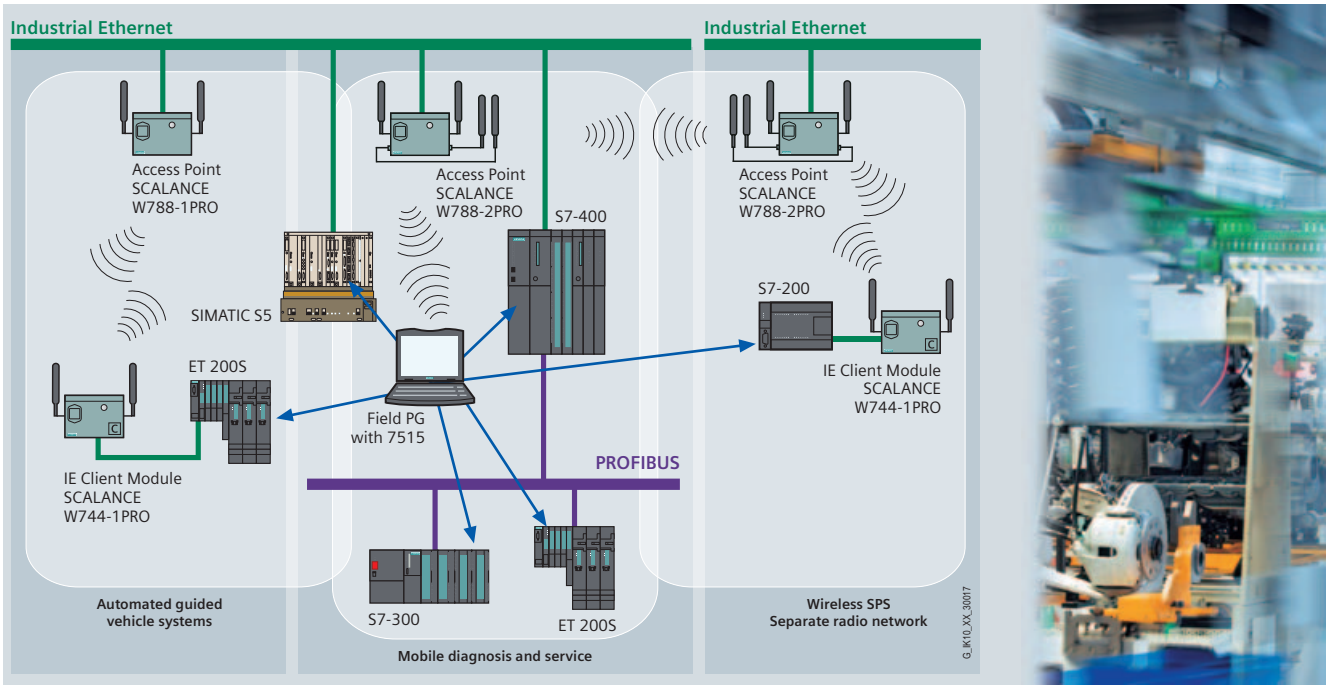


The CP 7515 is a PC card (32-bit CardBus) with two integral antennas for operation in an Industrial Wireless LAN (IWLAN) radio network with reliable communication (e.g. in production and manufacturing) or also in the office sector.

The use of the CP 7515 in a standard WLAN according to IEEE 802.11b/g and IEEE 802.11a at 2.4 GHz or 5 GHz is also possible. This means that a single radio network is sufficient for reliable operation of a process (IWLAN) as well as for critical process data (e.g. alarm signals), as well as for non-critical communication (WLAN), e.g. for service and diagnosis

The CP 7515 supports the following communication services:

- ISO and TCP/IP transport protocols
- PG communication
- S7 communication
- S5-compatible communication (SEND/RECEIVE)



Possible applications with OPC (OLE for Process Control)

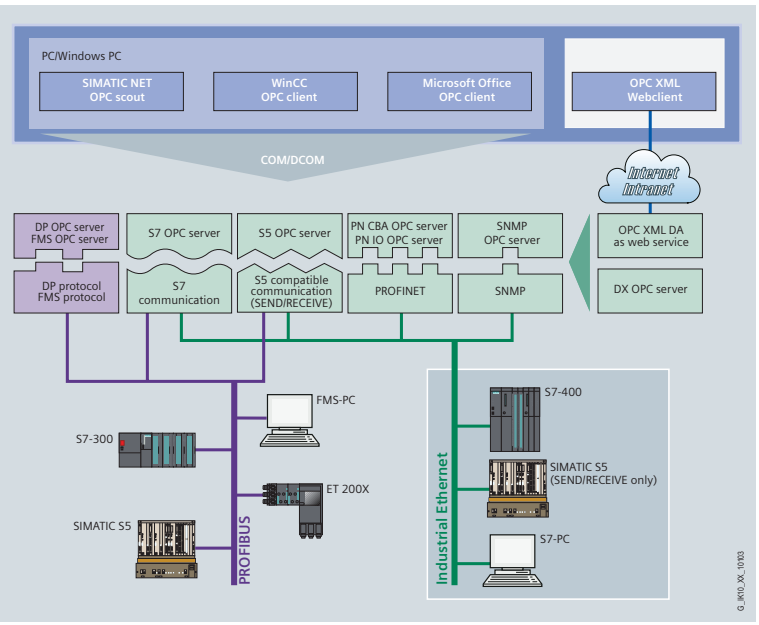
OPC is a standardized, open and vendor-independent interface that is widely used in automation.

As a rule, OPC communication consists of a server and one or several clients. These clients can be located on the same PC or also on other PCs in the Ethernet network.

OPC servers are available for a wide variety of protocols, such as PROFINET, SNMP and networks, such as Ethernet.

OPC servers from SIMATIC NET have the following functions:

- Connection of automation solutions of various manufacturers to SIMATIC PLCs, field devices and Ethernet network components
- Servers for OPC DA, OPC DA-XML and OPC A&E-capable clients
- Configuration with STEP 7 or alternatively in free NCM PC
- Programming interface for the OPC server via the Custom Interface (C++) and "Automation Interface" (VB)
- Optimized communication between OPC Client and Server by grouping of variables (items)
- Application examples and documentation



OPC servers for Industrial Ethernet:

S7 OPC server
(contained in SOFTNET-S7 for Industrial Ethernet, S7-1613 and SOFTNET-S7 Lean)

The S7 OPC server permits communication with SIMATIC S7-300 / 400 systems via the S7 protocol and with SIMATIC S5 systems via SEND/RECEIVE.

PN CBA OPC server

The PN CBA OPC server implements the access to variables of PROFINET CBA components such as the IE/PB Link.

Components that have been generated with the engineering tool SIMATIC iMap can be used with STEP 7 defined variables and symbols.

PN IO OPC server (included in SOFTNET PROFINET PN IO)

The PN IO OPC server permits communication with the PROFINET IO devices via the PROFINET protocol.

This means that existing installations can also be expanded with the PROFINET functionality

SNMP OPC server

The SNMP OPC server permits the diagnosis and parameterization of any Ethernet devices, such as switches, that have SNMP functionality (Simple Network Management Protocol). SNMP is an open and widely used protocol for the administration of TCP/IP networks. Products with SNMP functionality have an "SNMP agent" that makes information available in a structured form.
www.siemens.de/snmp-opc-server

OPC Server for PROFIBUS:

S7 OPC server
(contained in SOFTNET-S7 for PROFIBUS, S7-5613)

The S7 OPC server permits communication with SIMATIC S7-300 / 400 systems via the S7 protocol and with SIMATIC S5 systems via SEND/RECEIVE protocol.

DP OPC server
(contained in DP-5613, SOFTNET-DP and SOFTNET-DP slave)

The DP OPC server permits access to process and diagnostic data of the distributed IO.

FMS OPC server (included in FMS-5613)

The FMS OPC server offers simple communication with FMS-capable field devices.

Function overview

SIMATIC PG / SIMATIC PC

Hardware	Software	Operating system					Transport protocol		OPC	PG/ OP*	S7 communication					PROFI-NET		S5 comp. communic.		IT 4)	Time of day			IWLAN
		Win XP Professional	Win 2003 Server	Win 2000 Prof./ Server	Linux	UNIX	ISO	TCP			Put/Get Client	Put/Get Server	BSEND BRECV	USEND URECV	H communication	C 5)	D 6)	SEND/RECV	Fetch/Write		Sender	Receiver	Forward	
CP 1613 A2	S7-1613	■	■	■			■	■	■	■	■	■	■					■	■	■	■	■		
	S7-REDCONNECT	■	■	■			■		■	■	■	■	■		■			■	■		■	■		
CP 1616 CP 1604	DK-16xx PN IO	■ 7)	■ 7)	■	■ 7)	■ 7)		■								■	■							
integr. interface CP 1612	SOFTNET-S7	■	■	■			■	■	■	■	■	■	■					■	■	■				
	SOFTNET PN IO	■	■	■				■	■							■								
	SOFTNET-S7 Lean	■	■	■			■	■	■	■	■	■	■					■	■	■				
	SOFTNET-PG	■	■	■			■	■												■				
CP 7515																								■
CP 7515	SOFTNET-S7	■	■	■			■	■	■	■	■	■	■					■	■	■				
	SOFTNET-S7 Lean	■	■	■			■	■	■	■										■				
	SOFTNET-PG	■	■	■			■	■												■				
Ethernet boards 1)	SOFTNET-S7	■	■	■			■	■	■	■	■	■	■					■	■	■				
	SOFTNET-S7 Lean	■	■	■			■	■	■	■	■	■	■					■	■	■				

You can find more informations with the search function using the ID in the internet
http://www.siemens.com/simatic-net/ik-info

1) Supported by TLI/DLPI drivers; UNIX software without OPC server
2) From V2.0
3) For S5 compatible communication only
4) The IT functionality arises in conjunction with the CPs and the Windows software of the PC
5) PROFINET IO-Controller
6) PROFINET Device
7) via driver porting

*) PG/OP communication

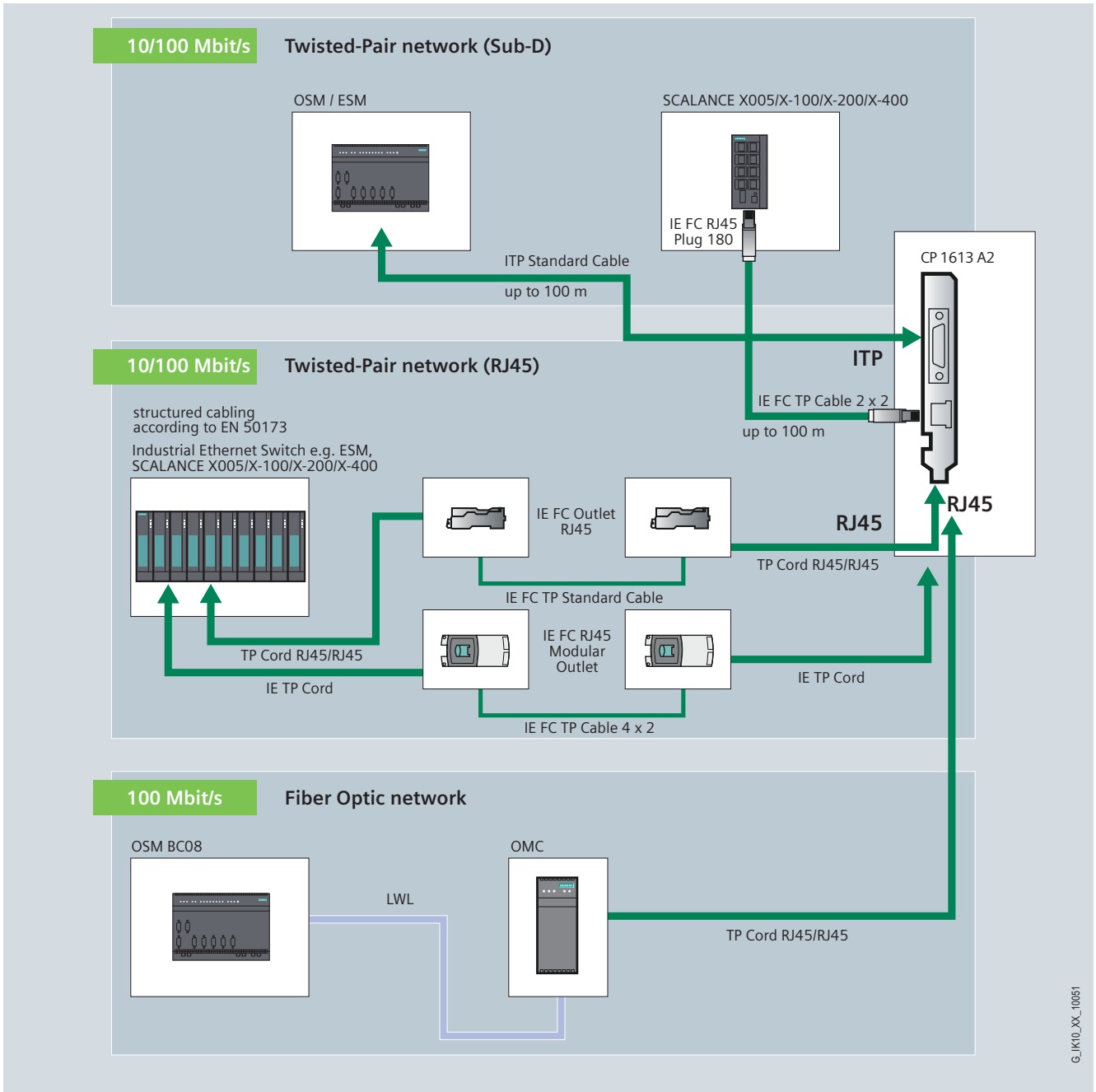
■ suitable

not suitable

G_IK10_XX_10058

Industrial Ethernet
Connection options

The connection options of an electrical or optical network or of 10 or 100 Mbit/s to a CP are implemented with various network components.



Network connection options, e.g. for CP 1613 A2

Advantages of Industrial Ethernet at a glance

High availability

- Topologies in linear, tree, ring and star structures
- High performance
- Large quantity frameworks
- Integration right down to field level from office to production
- High-speed media redundancy in the range of milliseconds in electrical/optical ring topology
- Redundancy also for wireless links (Industrial Wireless LAN)
- Redundant power supply: secure low voltage 2 x 24 V DC

Diagnostics

- LEDs (link status, power, collisions, data)
- Simple, economical monitoring and function control of the devices via signal contact
- Integration of network diagnostics into STEP 7
- Integration of messages from the network into any existing HMI system (e.g. WinCC)
- No separate network management software necessary
- SNMP, Web-based Management, RMON

Industrial Ethernet components

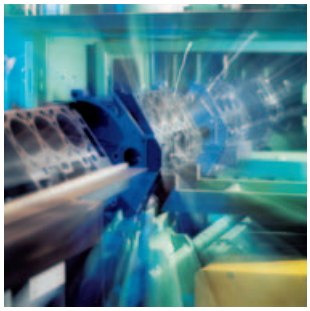
- Based on the Standard IEEE 802.3 for use in tough industrial environments
- Rugged all-metal enclosure
- Network components with extended temperature range from -40 °C to +70 °C
- Modular design for DIN rail mounting
- Excellent resistance to vibrations

Not sensitive to electromagnetic interference

- Safeguards reliable data traffic even in environments subject to EMI

Permanently secure and quick-assembly plug connectors

- RJ45 all-metal connector with additional locking
- Switches with sleeves for rugged networking
- Fast local assembly using the FastConnect cabling system with RJ45 technology
- BFOC for fiber optic cables

Further Information

- **Visit us on the Internet at our SIMATIC NET homepage:**

  www.siemens.com/automation/simatic-net

  The site provides information on products and solutions, the latest information on SIMATIC NET, as well as events or specialist publications.

- **Information about contact partners in your area who will be happy to talk to you:**

  www.siemens.com/automation/partner

- **Order directly via Internet with A&D Mall:**

  www.siemens.com/automation/mall

In various SIMATIC NET components (e.g. SCALANCE, OSM/ESM, CPs with IT functions) comprehensive parameter and diagnostic functions (e.g. Web Server, network management) are available via open protocols and interfaces. The open interfaces create an access to components which can however result in misuse through illegal activities.
By using these functions and the open interfaces and protocols (e.g. SNMP, HTTP, Telnet) suitable security measurements should be taken to ensure there is no unauthorized access to components and networks, particularly those connected to the WAN/Internet.
Automation networks should be separated from the company network by means of suitable firewall systems such as SCALANCE S.

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